Portion Distortion and Public Perception: How Serving Size Guidelines are Over-Serving and Under-Serving the Consumer

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Abstract: This paper examines public perceptions regarding the serving sizes listed on the labels of packaged foods. The author conducted four surveys toward this end: 1) a survey of Brown University undergraduates in which students were asked to estimate the number of servings in series of different food containers; 2) a similar survey of New York City residents sorted by age, race and gender; 3) a survey of the ability of convenience store and supermarket employees to determine and explain the serving size data on packages; and 4) a survey of the ability of adults and children in low income neighborhoods to determine and explain the serving size data on packages. The paper also catalogues several of the problems with the current system of determining serving sizes including portion distortion (the relatively small size of servings compared to what people actually eat), the separate scales used by the FDA's food label and the USDA's Food Guide Pyramid, and the false but widespread belief that serving sizes are determined by the manufacturer. Several changes in the rules governing serving size are proposed from the conservative (printing determined by the FDA beside the serving size) to radical (eg. providing nutritional data for the entire package rather than per serving).

Americans are the heaviest people on earth.[1] The medical community and the media continually remind us that obesity has reached epidemic proportions and that we are on the precipice of a public health crisis. Looser belts lead to tigher arteries; fast food means slow death. The bulge cuts across all ages, races and genders; it affects smokers and non-smokers alike. And while the disparity between rich and poor, educated

[1]Kesten, Deborah. The Enlightened Diet, *Spirituality and Health Magazine*, Winter, 2003. But see Gibbs, W. W. Gaining on Fat, *Scientific American*, August 1996, Pp. 8894, for the argument that natives of Western Samoa and certain South Pacific islands are heavier.

and uneducated, grows in so many measures of well-being, we can take little solace in knowing that both the haves and the have-nots are fattening up.[2] Surgeon General David Satcher reported in 1999 that 60% of Americans are overweight and that obesity causes approximately 300,000 deaths in the United States each year; he predicted that obesity will soon overtake smoking as the nation's leading killer.[3] The Surgeon General also strongly advocated a more active role for government officials in combatting this scourge. Many people believe that dealing with [being] overweight and obesity is a personal responsibility, Satcher stated in the forward to the report. To some degree they are right, but it is also a community responsibility.[4] Other public figures, including incoming Senate Majority Leader Bill Frist and Senator Jeff Bingaman of New Mexico, have echoed this call. President Bush even recently turned the south lawn of the White House into a temporary fitness center, complete with climbing wall, to draw attention to the need for physical fitness.[5] The impact of these measures remains unclear. For while near consensus exists that American waistlines are growing, the experts are far from agreement on exactly *why* we are putting on pounds.

Katherin Flegal, an epidemeologist at the National Center for Health Sciences who studies reasons for weight gain, explains that while the data are confusing...the causes of the obesity epidemic most likely are too much food and too little physical activity.[6] In other words: The system does not work because it is broken.[7] Yet any attempt to explain our expanding waistlines in terms more precise than under-exertion and over-consumption inevitably meets with stiff opposition. One school of thought attributes the crisis to the growth

[2]Mokdad, Ali, et al. The Spread of the Obesity Epidemic in the United States, 1991-98, *JAMA,* Ocotber 27, 1999.

[3]Surgeon General: Obesity Rivals Tobacco As Health Ill, *USA Today*, Dec. 11, 2001.

[4]Willis, Melinda. Weight Epidemic. See ABCnews.com archive at http://abcnews.go.com/sections/living/DailyNews/overweight_kids011213.htm

[5]See First US Federal Bill to Address Obesity, Financial Times, July 12, 2002. Frist and Bingaman have co-sponsored legislation to increase funding for anti-obesity education campaigns at the state level.

[6]LaFontaine, Thomas, and Roitman, Jeffery. Lifestyle Management of Adult Obesity. http://www.vhct.org/case2500/etiology.shtml.

[7]Although even this truism has come under attack as some scientists have attempted to connect obesity with the impact of stress on the endocrine system. See, for example, The Real Cause of the Obesity Epidemic available at http://victoria682.tripod.com/thelargestofall/id1.html

of the fast food industry. As the number of families in which both spouses work outside the home has increased, so has the need for relatively labor-free dining alternatives. Highly effective advertising, increased pressures on time, and even the expansion of the interstate highway system have probably contributed to this soaring demand. Eric Schlosser, the author of the best-selling *Fast Food Nation*, lays the blame at the drive-thru windows of the national fast food chains. If you look at the rise of the obesity rate in the United States, he argues, it's grown pretty much in step with the rise in fastfood consumption. Fast food, of course, means fatty food. And excessive fatty food intake causes obesity....or at least that was the general consensus from the mid-1970s until very recently. However, contrarians who blame weight gain on complex carbohydrate intake are now gaining ground in the public debate.[8] It may not be the burgers, but the buns, that are doing in our diets. Of course, others view any dietary hypothesis at all as too simplistic.[9] They pin at least some of the blame on desk jobs and the time-saving techonologies of the information age. Many people point to fast food, but Bill Gates is probably as much to blame as Ronald McDonald, notes James Hill, director of the Colorado Clinical Nutrition Research Unit at the University of Colorado. Even if we got rid of every McDonald's, Burger King, and Wendy's in the country, we'd still have a big problem.[10] Meanwhile, industry groups have blasted any efforts to shift blame from the consumer to the manufacturer. The National Soft Drink Association has argued against further restrictions on vending machines in schools, and the National Restaurant Association has branded efforts to blame dietary choices for obesity as simplistic.[11] So while a few disgruntled consumers have attempted to use the tort system for relief, claiming McDonalds has made them fat,[12] the policy makers in Washington and the state capitals have been reluctant to act. Unlike with lead paint or tobacco, there is no easy target.

[8]Taubes, Gary, What If It's All Been a Big Fat Lie?, *New York Times Magazine* July 7, 2002.

[9]New Book Blames FastFood Industry for US Childhood Obesity Epidemic, *CBS News* archive. See: http://www.cbsnews.com/stories/2002/01/31/health/main327051.shtml

[10]Woolston, Chris. Why is there an Obesity Epidemic? *Consumer Health Interactive*. Available on-line at: http://www.ahealthyme.com/topic/obesityepidemic

[11]Surgeon General: Obesity Rivals Tobacco As Health Ill, *USA Today*, Dec. 11, 2001

[12]See e.g., Santora, Marc, Two New York Girls Suing McDonald's Over Obesity, *New York Times*, November 22, 2002.

One area where the government has taken action is with regard to product labeling. If consumers are responsible for their own decisions, the reasoning runs, they must have the information necessary to make those choices. They should know what they are eating. They should also know how much they are eating. Several well-publicized studies have examined portion sizes at fast food and take out restaurants in order to document portion distortion: The standard quick-fix meals today are far larger than they were forty years ago. In the 1950s, for example, McDonald's original twoounce serving of french fries totaled about 200 calories, but by 2000 the restaurant offered a sevenounce super size sibling that packed 610 calories.[13] Other studies have shown an increase in the amount of food per package for processed groceries. A single bottle serving of CocaCola has increased from 6 1/2 to 20 ounces in nearly the same timespan.[14]All of these studies have focussed on the actual amount of food contained in portions or packages. Yet the public perception of the amount of food contained in packages seems just as important as the true amount. If consumers recognize that they are eating more, then we are at least maximizing the autonomy that the food industry claims to value so dearly. However, if consumers do not recognize that they are eating more–and particulary, if the government labels mislead them into believing that they are consuming less than they are–then we are actually reducing consumer autonomy. In order to make these assessments we need to find out to whether the serving size listed on food labels reflect the eating habits of ordinary Americans and also whether these consumers are capable of using and interpreting that data effectively.

[13]BeMent, Cynthia. Remembering Real Portion Sizes Available at: http://www.cookinglight.com/cooking/hl/nutrition/article/0,13803,362930,00

[14]See BeMent above. See also: Young, Lisa, and Nestle, Marion. The Contribution of Expanding Portion Sizes to the United States Obesity Epidemic. *American Journal of Public Health*. Volume 92. 246-249. 2002.

I. Background: Serving Sizes and the Law

Almost all packaged food products sold in the United States must contain a label.[15] Both the format and the content of these labels is strictly regulated by the Food and Drug Administration.[16] Manufacturers must indicate fourteen different pieces of nutritional information on their packages including the total number of calories per serving, the fat content per serving, and the amounts of such specific nutrients as vitamin A, vitamin C, sodium and calcium; they also have the option to list other nutritional facts such as potassium content, relative quantities of monounsaturated fat and polyunsaturated fat, and calories from saturated fat.[17] All of these guidelines were promulgated between 1993 and 1995 as required under the Nutrition Labeling and Education Act of 1990. Some labeling requirements did exist prior to the passage of NLEA. A series of FDA regulations implemented between 1973 and 1975 required the listing of certain vitamins and minerals on foods that have nutrients added or make a nutritional claim.[18] These regulations meant that the vast majority of packaged foods did list the percentage of Recommended United States Daily Allowances for the eight nutrients mandated by law.[19] Although a few changes were implemented over the next two decades, such as the addition of sodium as a required component and potassium as an optional component in 1984, the labels remained virtually static during this period.[20] Yet as the public became more health conscious and

[15]Retailers are also required to post nutritional data for the top twenty non-packaged food items in each of the following categories: fruits, vegetables, fish and shellfish. Initially exempted from such regulations were foods sold in restaurants and prepared foods sold at counters in grocery stores, infant formula, foods such as lifesavers contained in extremely small packages, foods sold in bulk, plain coffee and tea, spices, foods containing insignificant amounts of nutrients and foods sold by retailers with total sales less than $500,000. *Nutrition Labeling and Information Act of 1990.* Available at: http://thomas.loc.gov/cgibin /query/D?c101:9:./temp/∼c101hQJrzt:e587:

[16]Similar regulations governing meat and poultry products have been adopted by the United States Department of Agriculture. Both the FDA and USDA promulgated their rules in January, 1993.

[17]See The New Food Label at http://www.ianr.unl.edu/pubs/foods/nf115.htm for a complete list of all the specific requirements.

[18]Institute of Food Technologists at http://www.ift.org/education/food_industry

[19]Getty, Vicky and Evers, Bill. Electronic Food Rap Vol. 8, No. 24. Some data derived from Pennington, J. and Hubbard, V., Derivation of Daily Values Used for Nutrition Labeling, Journal of the American Dietetic Association, Dec. 1997.

[20]Kurtzweil, Paula. Good Reading for Good Eating. *FDA Consumer*, U. S. Food and Drug Administraion, May 1993..

increasingly aware of the link between diet and chronic disease, particularly after the appearance of the 1988 Surgeon General's Report on Nutrition and Health and the National Research Council's Report on Diet and Health, both consumer groups and manufacturers argued for altered guidelines. Ed Scarborough, director of the Office of Food Labeling at the FDA's Center for Food Safety and Applied Nutrition, explained the impetus for NLEA as a cyclical interaction between industy and the general public. The line from industry used to be: 'Nutrition won't sell food: It's time, taste, convenience,' he explained. But by the time we got to the 1980s, nutrition clearly was selling products. Industry started recognizing this and started making claims about the food. And as these claims became more far-fetched and consumers began to doubt them, the food industry sought the arbitration and imprimitur of the goverment.[21] Meanwhile, public health groups lobbied for changes that would promote healthier eating and lead to a reduction in fat consumption.[22] Thus, today's detailed food labels were born.

Among the most significant changes effected by NLEA was the regulation of a standard serving size for the nutritional data listed on the package. Prior to the implementation of the 1990 Act, serving sizes were established by the manufacturers. Connie Diekman, a spokesperson for the American Dietetic Association, explained that such a system was open to abuses. Since a serving size was whatever a manufacturer said it was and many packages did not even list this information...people used to assume that a small bag of potato chips contained a single serving, which wasn't always true.[23] As a result of NLEA, strict guidelines exist for the setting of the serving size for which nutritional data is then listed. The act defines serving size as the amount of food customarily eaten at one time and is based on the FDA's list of Reference Amounts

[21] See http://vm.cfsan.fda.gov/~dms/fdlabel2.html

[22] Finke, Matthew. Did the Nutrition Labeling Act Affect Food Choice in the United States? Available at: http://www.ers.usda.gov/briefing/foodmarketstructures/ conferencepapers/Finke.pdf

[23] Papazian, Ruth. Healthful Snacks for the Chip-and-Dip Crowd. Available at: http://www.yourpediatrician.com/Snacks.htm

Currently Consumed per Eating Occasion.[24] The best way to understand the significance of this change is with a specific example. When portion determinations were left to the manufacturer, the serving size for frozen yogurt ranged from one third of a cup to three quarters of a cup; today, all frozen deserts have a standard half-cup serving size.[25] Consumers no longer need a calculator in order to engage in comparative shopping. The fixed serving size regulations make it much easier to compare the nutritional contents of two different products. What is not so clear is whether the serving sizes reflect public consumption habits and whether individual consumers can use the nutritional data that is listed per serving effectively in their own diets. At least one nutrition expert notes that the actual amount of frozen yogurt ingested at one sitting is, on average, 1.5 cups–nearly three times the FDA's established serving size.[26] Comparison shopping between different types of products continues to be extremely difficult as well. While the uniform serving size for frozen yogurt is one-half cup, the uniform serving size for yogurt (the non-frozen variety) is one full cup. Moreover, the FDA's serving sizes are not the same as those used by the Department of Agriculture in constructing the well-known Food Guide Pyramid. While both are allegedly based upon the amount of food eaten at one time (although the FDA notes that based upon does not necessarily mean equal to), the USDA's standard servings are consistently smaller.[27] Whether consumers can adequately use the two scales in conjunction with one another–or even whether they know that they two agencies set serving sizes differently–remains unclear.

II. Serving Size and Public Perceptions

[24]The Food Label, *FDA Backgrounder*, US Food and Drug Administration, May 1999. The detailed guidelines can be found at: http://vm.cfsan.fda.gov/∼dms/qalab18.html

[25]Comparison data available at: www.oxygen.com/experts/joan/joan_20010320.html

[26]Tackett, Chad. Understanding Food Labels and Health Claims Available at: http://www.personalhealthzone.com/labels.html

[27]Herring, David, et al. Serving Sizes in the Food Guide Pyramid and on the Nutrition Facts Label: What's Different and Why? *USDA Center For Nutrition Policy and Promotion*, December 2000.

One of the goals of this paper was to determine whether or not the serving sizes indicated on food packaging actually do provide the public with accurate nutritional information. Four surveys were conducted over the course of three months (August-October 2002) to ascertain the role that these labels actually play in consumer choice; the results are outlined below. Yet the most striking feature of these surveys may have been the oral and written comments that accompanied them. These revealed that food labeling as a whole means very different things to different people. Ben, an eighteen year old college student in Providence, Rhode Island, explained that the serving sizes are manipulated by the manufacturers to get people to eat what they don't want to. These sentiments were echoed by Suzanne, a teacher in Brooklyn, who said she never looks at the nutritional data at all because it's just there to trick you. But Angel, a self-described building worker in Manhattan, was confident that the government puts those labels on to make sure that consumers are well-informed. And Petel, a retiree in Harlem, thinks the nutritional information is extremely important because it tells you how much you're getting for your dollars. A far more sophisticated response comes from Alice, a homemaker from suburban New York City: I never look at the serving sizes because they bear no relationship to reality. They don't reflect how people really eat. She adds that she strongly advocates changing the regulations governing labelling. If I thought they were accurate, she says, I do think I'd look at them. Each of the following four studies attempted to assess sentiments like those above and to present them in quantified terms.

A. The Brown University Study[28]

Ninety-one Brown university undergraduates were asked to predict the indicated number of servings in six different food items: a bag containing 92.1 grams of Nacho Cheesier Doritos, a package of 150.3 grams of

[28]The survey was conducted between October 1, 2002 and October 15, 2002. A sample survey questionnaire is included in Appendix A.

M&Ms, a 92 gram container of Mini Oreos, a 319 gram can of Campbell's Green Pea Soup, a plastic 8 fl. oz. bottle of vanilla Coke and an apple. The actual and estimated number of servings per packages is indicated in the table below:

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.3516	- 32.8
M&Ms	3.5	2.1014	- 40.0
Mini Oreos	3.0	1.9000	- 36.7
Green Pea Soup	2.5	1.9604	- 21.6
Vanilla Coke	2.5	2.1055	- 15.9
Apple	1	1.0109	+ 1.1

All but one student believed that the apple contained one serving. Yet the vast majority of students underestimated the number of servings in each of the other packages. Moreover, 88.0 % of the students surveyed indicated they used this information to make purchasing decisions either often or sometimes and 91.2% said they often or sometimes use this data to extrapolate nutritional information. If these students are indeed using their estimates in combination with the other data on the packaging, they would have made the following underestimates as well:

Item Actual Calories Estimated Cals. Actual Fat Cals. Estimated Fat Cals.

Nacho Doritos	490	329.4	245	164.5	

M&Ms	735	441.0	280	168.0	
Mini Oreos	420	265.8	150	95.1	
Green Pea Soup	450	352.8	62.5	49.3	
Vanilla Coke	250	210.3	0	0	
Apple	80[29]	80.8	0	0	

It is also worth noting that while all five packaged items produced significant underestimates, the students were farthest off the mark on the packaged snack foods. A direct correlation existed between the amount of fat in any given item and the likelihood of students to underestimate the number of serving sizes (and thus the fat content) per package.

Another of the goals of the Brown student survey was to ascertain whether an individual's own background knowledge in the field of nutrition was predictive of whether or not he or she was able to estimate correctly the number of serving sizes per package. Student were asked to rate their own nutritional knowledge on a scale of one to ten. The average student self-assessment was a 6.2. Dividing the students into those whose self-assessment was below average and those whose self-assessment was above average reveals the following:

Below Average Self-Assessment (39 Students)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.5423	- 27.4	

[29]This approximation is based on the USDA pocket guide estimates. Available on-line at: http://www.hoptechno.com/book20.htm. (November 10, 2002)

M&Ms	3.5	2.3043	- 34.3
Mini Oreos	3.0	2.7383	- 8.7
Green Pea Soup	2.5	2.0908	- 16.4
Vanilla Coke	2.5	2.2017	- 11.9
Apple	1	1.0000	0

Above Average Self-Assessment (52 Students)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.2103	- 36.8
M&Ms	3.5	1.9492	- 44.3
Mini Oreos	3.0	1.3078	- 56.4
Green Pea Soup	2.5	1.8626	- 25.5
Vanilla Coke	2.5	2.0333	- 18.7
Apple	1	1.0192	+ 1.9

Those students whose self-assessed nutritional knowledge exceeded the average were decidedly *less accurate* in their serving size predictions than those whose self-assessed nutritional knowledge fell below the average. The implications of this find are disturbing: At least some segment of the student population surveyed believe that they are far more knowledgeable than they actually are on the subject of food labeling and they are making nutritional choices accordingly. These individuals may also be bringing their inaccurate

perceptions to bear on the decisions made by their friends and families.

A second measure of nutritional knowledge might be found in the subjects' concern regarding their own weight. Accordingly, students were asked: Have you been on a weight-loss diet in the previous two years? Twenty-seven out of eighty-eight answered yes.[30] The following tables compare the dieters to the non-dieters:

Students on Diet in Previous Two Years (27 Students)

Item	Actual Serving Sizes	Estimated Serv. Sizes	% Error of Estimate
Nacho Doritos	3.5	2.4215	- 30.8
M&Ms	3.5	2.2132	- 36.8
Mini Oreos	3.0	1.8622	- 39.9
Green Pea Soup	2.5	2.0124	- 19.5
Vanilla Coke	2.5	2.2055	- 11.8
Apple	1	1.0000	0

Students Not on Diet in Previous Two Years (61 Students)

Item	Actual Serving Sizes	Estimated Serv. Sizes	% Error of Estimate
Nacho Doritos	3.5	2.3206	- 33.7

[30]Three students did not respond to this question.

M&Ms	3.5	2.0519	- 41.3
Mini Oreos	3.0	1.9197	- 36.0
Green Pea Soup	2.5	1.9397	- 22.4
Vanilla Coke	2.5	2.0612	- 17.6
Apple	1	1.0000	0

The dieters were more accurate than the non-dieters in predicting the serving sizes for four of the five packaged items, but the differences in accuracy were not very large for any of the labels. One explanation for this finding may be that while dieters are more knowledgeable, their tendency to estimate in their own favor when it comes to calories may undermine any advantage that this knowledge provides. Another possibility is that the labels are so misleading that even those actively attuned to their own weights are consistently misled.

Students were also asked whether or not they intended to become physicians. One might use this data as another indicator of student background knowledge; presumably those students who will go into the health sciences are more likely to know about nutritional labeling. Another advantage of comparing would-be physicians with others is at the knowledge provider end: Physicians are far more likely to give health and nutritional advice to others than are members of the general public. Moreover, when they do so, they are far more likely to be trusted. Here are the results for the thirty-four students who plan to pursue careers in medicine and the fifty-seven who do not or do not yet know:

Pre-Med Students (34 Total)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	1.9883	- 43.2
M&Ms	3.5	2.0600	- 41.1
Mini Oreos	3.0	1.6794	- 44.0
Green Pea Soup	2.5	1.8951	- 24.2
Vanilla Coke	2.5	2.0986	- 16.1
Apple	1	1.0000	0.0

Not Pre-Med Students (57 Total)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.5683	- 26.6
M&Ms	3.5	2.1261	- 39.4
Mini Oreos	3.0	2.0315	- 32.3
Green Pea Soup	2.5	1.9993	- 20.0
Vanilla Coke	2.5	2.1096	- 15.6
Apple	1	1.0175	+ 0.18

The future physicians predicted the number of servings far less accurately than those Brown students not planning on careers in medicine. The cause of this disparity is beyond the scope of this paper. It is

theoretically possible that pre-medical students come from wealthier backgrounds and were less likely to do their own grocery shopping when they grew up. Yet the cause does not appear nearly as significant as the implications. What is most important to note is that those individuals entrusted with providing nutritional information to the public are *less aware* than that public itself as to the nature of serving sizes.

One final aspect of the Brown survey tried to gauge the degree to which students use the serving size information of package labeling. Surprisingly, there was little relationship between the degree to which they relied on these figures and their belief as to the source of these figures. The following were the sources offered in response to the inquiry: Who determines serving size?

FDA / Government Agency	49
Manufacturers	32
Independent Experts	3
Insurance Com- pa- nies	1
Non-Responsive or Blank	6

One might expect those students who believed the government to be determining the serving sizes to have more faith in their accuracy and to use them in decision-making more regularly than those who thought that the numbers were assigned by the manufacturers. This was surprisingly not the case. Here is a breakdown of responses to inquiries regarding the use of nutritional information:

Question: Do you use nutritional labels in making purchasing decisions?

Source of Serving Size Data Always Often Sometimes Rarely/Never

FDA / Government Agency	2	17	24	6
Manufacturer	1	12	16	3

Question: Do you extrapolate from serving sizes to assess nutritional values?

Source of Serving Size Data Always Often Sometimes Rarely/Never

FDA / Government Agency	0	15	29	5
Manufacturer	1	13	14	2

In other words, 87.8% of those who believe the Food and Drug Administration or the government regulates serving sizes use nutritional labels to make purchasing decisions at least some of the time compared with 90.1% of those who think the matter is entirely in private hands. And 89.8 % of those who believe the Food and Drug Administration or the government regulates serving sizes use that serving size information to calculate nutritional values compared with 87.5 % of those who think manufacturers determine these figures. This result suggests that publicizing the government's role in setting serving sizes will accomplish little toward surmounting this informational barrier.

The conclusion to be drawn from the Brown study is that these undergraduates were woefully misinformed when it came to determining serving sizes and that the serving sizes themselves do not reflect the eating habits of college-aged consumers. Even those who self-identified as highly knowledgeable in matters of nutrition and those who plan to pursue careers in medicine fared poorly on a very basic test of their awareness.

B. *The New York City study*[31]

One hundred three residents of the New York City metropolitan area responded when asked to predict the indicated number of servings in six different food items; all products were the same as those used in the Brown University study except that a can of Campbell's chicken noodle soup was substituted for the can of green pea soup. These individuals were approached randomly in public places at a series of locations around New York City and asked if they would take part in a five minute survey to assist a Harvard Law student in his research[32]; the results may be somewhat skewed in that a good number of those approached declined to participate. These are the results from those who did agree to estimate serving sizes:

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.48	- 29. 1
M&Ms	3.5	2.76	- 21.1
Mini Oreos	3.0	2.21	- 26.3
Chicken Soup	2.5	2.02	- 19.2
Vanilla Coke	2.5	1.96	-21.6
Apple	1	1.00	0

Although the inhabitants of New York City were better able to predict the number of servings per container for four of the five–the exception being the bottle of Vanilla Coke–their predictions were still far below those

[31]This survey was conducted between September 15, 2002 and October 15, 2002. A sample survey questionnaire is included in Appendix A.

[32]The locations were Central Park, Riverside Park, the gardens surrounding Grant's Tomb, the courtyard of the Cathedral of St. John the Divine and the boardwalk at Coney Island.

actually found on the product labels. Since 64.1% of those surveyed indicated that they used these figures in making purchasing decisions and 62.1% of the respondents claim to extrapolate nutritional information from serving size data, it is worth tabulating the other underestimates that would have been made by the consumers in this study:

Item Actual Calories Estimated Cals. Actual Fat Cals. Estimated Fat Cals.

Nacho Doritos	490	347.6	245	173.6	
M&Ms	735	579.6	280	220.9	
Mini Oreos	420	321.0	150	114.6	
Chicken Soup	100	323.0	38	95.0	
Vanilla Coke	250	196.0	0	0	
Apple	80[33]	80.0	0	0	

It is worth noting that while these respondents vastly underestimated the number of servings in each of the three snack food items, they also underestimated the number of servings in the bottle of cola to a greater degree than did the undergraduates. While the Brown students were best able to predict the number of servings for the soda, the New Yorkers were best able to predict the number of servings in the soup. It is possible that this reflects consumer habits: Both adults and working class people may be much more likely than affluent college students to purchase soup. It is also possible that the relative overall success of the adults compared to the undergraduates has do to with the frequency with which the former must go grocery shopping. College students, much of whose food is provided by university refectories, are less likely to be

[33]This approximation is based on the USDA pocket guide estimates. Available on-line at: http://www.hoptechno.com/book20.htm. (November 10, 2002)

attuned to product labels in the first place.

One of the advantages of the New York City survey was that it permitted a series of comparisons based on gender, race[34] and age. The following are the comparisons in each of those categories. It is worth noting that respondents who asked were informed that their answers to each of these questions were optional; the disparity in the total samples results from significant number of applicants who chose not to respond to one or more of these questions.

Gender: Male Respondents (Total = 60)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.29	- 34.6	
M&Ms	3.5	2.70	- 22.9	
Mini Oreos	3.0	2.18	- 27.3	
Chicken Soup	2.5	2.04	- 18.4	
Vanilla Coke	2.5	1.92	- 23.2	
Apple	1	1.00	0.0	

Gender: Female Respondents (Total = 43)

[34]Racial groups for which data was compiled include non-Hispanic whites, non-Hispanic blacks and Latinos. Although four individuals self-identified as Asian-American and two as Other, those samplings did not seem large enough to draw any conclusions.

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.75	- 21.4
M&Ms	3.5	2.84	- 18.9
Mini Oreos	3.0	2.25	- 25.0
Chicken Soup	2.5	1.99	- 20.4
Vanilla Coke	2.5	2.02	- 19.2
Apple	1	1.00	0.0

Race: Caucasian (Non-Latino) Respondents (Total = 50)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.51	- 28.3
M&Ms	3.5	2.84	- 18.9
Mini Oreos	3.0	2.03	- 32.3
Chicken Soup	2.5	1.99	- 20.4
Vanilla Coke	2.5	1.91	- 23.6
Apple	1	1.00	0.0

Race: African-American (Non-Latino) Respondents (Total = 16)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.42	- 30.8
M&Ms	3.5	2.51	- 28.2
Mini Oreos	3.0	2.44	- 18.6
Chicken Soup	2.5	2.06	- 17.6
Vanilla Coke	2.5	2.01	- 19.6
Apple	1	1.00	0.0

Race: Hispanic/Latino Respondents (Total = 15)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.47	- 29.4
M&Ms	3.5	2.70	- 22.9
Mini Oreos	3.0	2.30	- 23.3
Chicken Soup	2.5	2.04	- 18.4
Vanilla Coke	2.5	2.02	- 19.2
Apple	1	1.00	0.0

Age: Respondents Under Age 30 (Total = 29)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.30	- 34.3
M&Ms	3.5	2.49	- 28.9
Mini Oreos	3.0	1.89	- 37.0
Chicken Soup	2.5	1.99	- 20.4
Vanilla Coke	2.5	1.91	- 23.6
Apple	1	1.00	0

Age: Respondents Age 30-50 (Total = 26)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.52	- 28.0
M&Ms	3.5	2.88	- 17.7
Mini Oreos	3.0	2.20	- 26.6
Chicken Soup	2.5	2.18	- 12.8
Vanilla Coke	2.5	2.01	-19.6
Apple	1	1.00	0

Age: Respondents Age 50 or above (Total = 19)

Item Actual Serving Sizes Estimated Serv. Sizes % Error of Estimate

Nacho Doritos	3.5	2.59	- 26.0
M&Ms	3.5	2.85	- 18.6
Mini Oreos	3.0	2.16	- 28.0
Chicken Soup	2.5	1.91	- 23.6
Vanilla Coke	2.5	1.96	- 21.7
Apple	1	1.00	0.0

The results of these breakdowns indicate that there is a significant gender gap when it comes to estimating serving sizes. Women's approximations tend to be far more accurate than men's. One could surmise that this stems from the fact that women are more likely to shop for groceries than are men. An alternative hypothesis is that women are far more likely to watch their waistlines than are men, particularly as they age, so that the small correlation between accuracy and dieting picked up among the Brown undergraduates is augmented among adult women. And yet a third possibility is that men tend to make estimates that favor themselves (eg. fewer calories per package) than women do. In contrast to gender, little variation appeared when the responses were sorted by race. It appears that blacks, whites and Hispanics are nearly equally ignorant when it comes to how much food is in a serving. Yet a significant correlation appeared when the surveys were evaluated by age group. Children and young adults fared the worst; they underestimated all others in four out of the five packaged food categories. This data dovetails neatly with that from the Brown University study–although it is worth noting that the young adults in general fared somewhat better than the Ivy League students in the first sample. Considering that young people are less likely to shop and presumably less likely to be diet conscious, this finding is not surprising. What was surprising was that

older people also fared poorly compared to the general population. Those fifty and older under-performed their middle-aged peers in every category. Middle-aged women, in other words, appear to be the best at predicting serving sizes. However, even they underestimate the number of servings per package by nearly twenty percent.

The general public was far less aware of who regulated serving sizes than the Brown undergraduates. They were also far less likely to use the information on the label. Yet the following data indicates a substantial number still are informed and many do use the serving size data on the package to make their purchasing and dietary choices:

Question: Who determines serving size?

FDA / Government Agency	50
Manufacturers	19
Independent Experts	1
Don't Know	28
Non-Responsive or Blank	5

Question: Do you use nutritional labels in making purchasing decisions?

Source of Serving Size Data	Always	Often	Sometimes	Rarely/Never
FDA / Government Agency	0	9	30	11
Manufacturers	0	2	11	6
Don't Know / Other	0	2	14	20

Question: Do you extrapolate from serving sizes to assess nutritional values?

Source of Serving Size Data Always Often Sometimes Rarely/Never

FDA / Government Agency	0	6	31	13
Manufacturers	0	1	12	6
Don't Know / Other	1	1	14	20

In other words, 64.1% of respondents use the labels to help them make purchasing decisions at least some of the time and 62.1% extrapolate nutritional values from that data. Yet a majority of these consumers were dissatisfied with the available data as the answers to the following questions indicate:

Question: Do serving sizes reflect how much ordinary people actually eat?

Yes No Don't Know / No Answer

28	41	34

Question: Should the serving sizes be changed to reflect ordinary eating habits?

Yes No Don't Know / No Answer

31

44

The general public, like Brown undergraduates, appears woefully unable to estimate the number of servings in a given food item. Yet while Brown students appear to be confident in their knowledge of serving sizes, the public at large seems somewhat aware that they are ill-informed. Or possibly that the system doesn't reflect reality. What may be most alarming is that many respondents, knowing that there were more servings per package than an ordinary person might believe, still underestimated the number of servings. The people appear to know that they are being fooled. They do not know how much they are being fooled.

C. The Point-of-Purchase Study[35]

Employees at forty-one convenience stores and thirteen supermarkets in New York City, Boston, New Haven and Providence were asked to assist a customer in determining the number of calories in a 92.1 gram container of Nacho Cheesier Doritos. The label on the item stated that the package contained 3.5 servings. The package then listed the nutritional data *per serving*, including the number of calories *per serving*. Each serving was said to contain 140 calories. Some simple mathematics reveals that the entire bag of chips contains 490 calories. The store employees appeared to have some difficulty extrapolating from the data on the package. The following is a breakdown of figures that they provided the customer:

Type of Vender 490 Calories 140 Calories Other Amount

[35]This study was conducted between September 1, 2002 and October 15, 2002.

Convenience Store	12	21	8
Supermarket / Grocery Store	6	6	1

Only 46% of the supermarket employees and 29% of the convenience store clerks were able to provide the customer in the study with the accurate total number of calories. The customer specifically stated that he was interested in the total number of calories *in the entire bag* and repeated this request if he were given the wrong information; this insistence did not change the estimate of even one employee. That is the total from the whole thing, explained Lance, a clerk at a convenience store in Providence. I'm pretty sure. His confidence was a rare find among these employees. Far more shared the viewpoint of Beatriz at a New York City bodega who commiserated with the customer that the packaging can be hard to read.

D. *The Adult-Child Study*[36]

The following study was conducted at fast food restaurants in Harlem. Fourteen adults diners, each in the company of only one child were asked, if their son or daughter would take part in a one minute study for a Harvard Law School research project.[37] The children, ages eight to thirteen, were then asked if they could determine the number of calories in a 92.1 gram container of Nacho Cheesier Doritos. This package was identical to the one used in the Point-of-Purchase study. The label stated that the bag contained 3.5 servings and the amount per serving listed 140 calories. That meant that the a consumer eating the entire snack would ingest 490 total calories. The following are the results for the fourteen children questioned:

Participant 490 Calories 140 Calories Other / Don't Know

[36]This study was conducted between October 15 and October 31, 2002.

[37]The fast food establishments in question included McDonalds, Kentucky Fried Chicken, Pizza Hut and Twin Donuts. Many individuals refused to participate in the survey and this may have an impact on the results.

Child (Ages 8-13)	0	7	6

None of the children asked could determine the number of calories in the package correctly.[38] The examiner informed the children that they were incorrect and then asked–for the sake of the study–if the parent would tell the child the correct number of calories. Here are the results for the adults:

Participant 490 Calories 140 Calories Other / Don't Know

Adults

8

4

1

Thirty-one percent of the adults could not provide the children under their charge with the correct information. Two of the adults even challenged the examiner. What do you mean it isn't 140? asked one woman. She got it right. It says it right here.

E. *Study Conclusions*

[38]One child did appear to understand the concept of multiplying by the number of servings, but she erred in the calculations.

These four studies together suggest that the information provided to consumers on food packaging is not accomplishing its stated goals. The general public is suspicious of the serving size alotments on the packaging, but they are not nearly suspicious enough. All of the individuals surveyed underestimated the number of servings in all of the packaged food items in the study by an average 29.4%. The numbers, like the obesity epidemic, transcended every demographic group measured. The small disparities in accuracy that favored women and those in their middle years pale before the woeful conclusion that most of the estimates in the Brown and New York studies were wildly innacurate. Even future physicians cannot correctly estimate the number of servings in a package. Of course, this data is only important because most people do use some of the nutritional data on the labels. Unfortunately, the adult-child study suggests that they use it incorrectly. The suspicion of the author is that people both guestimate the number of servings per package on their own, without paying much attention to that provided by the manufacturer, and that they then use their estimate in combination with the nutritional figures provided. Since their initial guestimate is far short of the total, they are actually ingesting far more calories than they suspect.

III. Policy Considerations

The goal of food labeling is a well-informed public. If the current system of listing nutrients per serving is not helping consumers make the educated choices that reflect a maximum of autonomy, it seems worthwhile to consider changes to the current labeling regime that might help it better achieve its stated ends. The three proposals below are neither mutually exclusive nor exhaustive. They are simply a handful of the many possible approaches to correcting the phenomenon of portion distortion as it applies to the labeling of

packaged food items.

A. *Consumer Education*

The simplest means of changing public understanding of serving size data might be a drive toward universal public education on the subject. School children ought to be taught at an early age how to read product labels and how to calculate the total nutritional value of the food in any given package.[39] Two additional statements should also be added to all food labels. One declaration would explain the mechanism for determining the overall calorie and fat content of the product and might even be accompanied by a warning. A sample is outlined below:

WARNING: The nutritional values listed below are calculated *per serving*. This package contains 4 servings. You should multiply the nutritional data below by the total number of servings in order to obtain accurate totals for the package.

A second statement would explain the origin of the data listed on the label and help assuage the doubts of consumers as

NOTE: All of this nutritional data is compiled according to strict guidelines established by the Food and Drug Administration, an agency of the United States government.

[39]The FDA did develop curricular material for students in grades 10 to 12 to explain how to use the current food labels. They are available at http://ific.org/relatives/17220.pdf No comparable offerings exist for younger children.

These changes would certainly increase the ability of ordinary consumers to read and interpret the nurtritional data c same time one must question any set of labels so complex that educational initiatives and clarifying statements are nece to be effective.

B. Standardize Systems

Another change that might benefit consumers would be a standardization of the serving sizes used in the Department of Agriculture's Food Guide Pyramind and the FDA's reference list. Currently four factors go into determining the USDA's serving sizes: typical portion sizes, ease of use, nutrition and tradition. For example, fruits and vegetable are generally considered to be contain one serving under the ease of use principle while tradition dictates that the traditional serving size for bread be one slice. While these sizes sometimes coincide with those established by the FDA–for example one cup is the standard serving size for milk under both systems–they often bear no resemblance to each other. For example the pyramid serving size for pasta is 1/2 cup cooked (about 1 ounce uncooked) while the label size is twice that amount.[40] The nominal explanation for the disparity between the two scales is that the systems serve two distinct purposes. The Food Guide Pyramid is allegedly designed to help consumers establish their dietary and nutritional goals. The product labels are allegedly designed for comparative shopping. Yet if the average consumer cannot understand the product labels in the first palce, it seems a stretch to expect them to use the data in conjunction with the food pyramid when buying groceries. The least one might want to do is print both figures on the package. A far better approach would be standardizing the two systems onto one scale.

C. Reducing Serving Sizes

[40]Herring, David, et al. Serving Sizes in the Food Guide Pyramid and on the Nutrition Facts Label: What's Different and Why? *USDA Center For Nutrition Policy and Promotion*, December 2000

A more radical approach to the problem of inaccurate serving sizes might demand a recalibration of the Reference Amounts Currently Consumed per Eating Occasion. If consumers understimate the number of servings per package by 29.4%, it would make good sense to adjust serving sizes accordingly; an even larger adjustment would probably be needed, in reality, because many of the respodents in these studies already were over-estimating in an attempt to compensate for perceived inaccuracies with the current labels. It might make sense to adopt generic serving size numbers that would be comparable across different food items similar to those that the American Heart Association currently uses for diabetics. One such proposal would apply these numbers to restraurant meals and fast food as well.[41] A far more effective change might be requiring manufacturers to list nutritional data for the entire package rather than per serving. This approach would certainly make sense for the bottles of soft drinks and bags of snack foods that the vast majority of consumers ingest at one sitting. The calorie and fat totals on packages would certainly be much higher as a result. These astronomical figures might in turn encourage health-conscious buyers to cut down on their purchases. While such an outcome would certainly help consumers make informed decisions and might improve the public health, it is not clear that such a drastic approach would appeal to bottom-line oriented manufacturers and trade associations. Industry might also oppose the additional one-tine cost of revamping food labels.

IV. A Brief Postscript

The food industry has made repeated and vocal claims that it is just as alarmed by the obesity epidemic as are the scientists and the government experts. The Grocery Manufacturers of America's mission statement

[41] See transcript of discussion at National Nutrition Summit available at http://www.nns.nih.gov/2000/activities/breakout_sessions/groupb.htm

on the subject declares that the food and beverage industry has a very important role to play in helping to improve fitness and nutrition among Americans.[42] At the same time, the GMA stresses that personal responsibility is the key to fighting flab. Crucial to this campaign is its goal that individuals...be empowered to improve their health through education and awareness.[43] And what better way to increase individual awareness than to correct food packaging to make the serving size data more informative? One might expect the Grocery Manufacturers of America to sign up immediately. At least I did. So I phoned them and asked. But they had no comment. Neither did the National Soft Drink Association. Nor did Frito-Lay nor Mars/Masterfoods, Nabisco nor Coke. Of the manufacturers of the food products used in my studies, only Campbell's Soup was willing to respond to my survey data. A spokesperson in Camden, New Jersey, told me that Campbell's believes that its labels accurately reflect the quality of the soup. I then asked about the quantity of the soup, but she said she had nothing further to add.

APPENDIX A

SERVING SIZE STUDY

Check One: PLME/Pre-Med _____ Not PLME/Pre-Med or Don't Know _____

Rank your nutrition knowledge on a scale of 1 through 10 (10 = most knowledge) _____

Have you been on a weight-loss diet in the previous two years? YES NO

Do you use nutritional labels in making purchasing decisions? YES NO

Do you extrapolate from serving sizes to assess nutritional values? YES NO

Who determines serving size? _____

[42]The statement can be found at http://www.gmabrands.com/nutrition/obesity.HTM

[43]See The Critical Role of Improving Responsibility in Personal Fitness and Nutrition, available at http://www.gmabrands.com/nutrition/respon.htm.

Estimate the number of servings in each of the following items:*

Item #1: (92.1 grams of Nacho Cheesier Doritos) _____

Item #2: (150.3 grams of M&Ms) _____

Item #3: (92 grams of Mini Oreos) _____

Item #4: (319 grams of Campbell's Green Pea Soup) _____

Item #5: (8 fl. oz Vanilla Coca Cola) _____

Item #6: (1 Red delicious apple) _____

Comments:

* Respondents were shown the packaged products.

SERVING SIZE STUDY

Gender: MALE FEMALE

Age: Under 30 years 30 years to 50 years Over 50 years

Race: Caucasian (non-Latino) African-American (non-Latino) Hispanic/Latino

Asian-American Other

Do you use nutritional labels in making purchasing decisions? YES NO

Do you extrapolate from serving sizes to assess nutritional values? YES NO

Who determines serving size? _____

Question: Do serving sizes reflect how much ordinary people actually eat? YES NO

Question: Should the serving sizes be changed to reflect ordinary eating habits? YES NO

Estimate the number of servings in each of the following items:*

Item #1: (92.1 grams of Nacho Cheesier Doritos) _____

Item #2: (150.3 grams of M&Ms) _____

Item #3: (92 grams of Mini Oreos) _____

Item #4: (319 grams of Campbell's Green Pea Soup) _____

Item #5: (8 fl. oz Vanilla Coca Cola) _____

Item #6: (1 Red delicious apple) _____

Comments:

* Respondents were shown the packaged products.