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REDUCED PACKAGING ANALYSIS OF CONSUMER GOODS

presented by

AARON F. FITCHKO

has been accepted towards fulfillment
of the requirements for

MASTER degree in PACKAGING

Major professor

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REDUCED PACKAGING ANALYSIS OF CONSUMER GOODS

By

Aaron F. Fitchko

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

School of Packaging

1999

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ABSTRACT

REDUCED PACKAGING ANALYSIS OF CONSUMER GOODS

By

Aaron F. Fitchko

This study was done to provide consumers with source reduction information for various consumer packaging systems. The study focused on 40 product categories that contained 252 product/packaging systems. The volume of packaging and weight of packaging were measured for every packaging system in each product group. Comparisons were made using packaging weight and packaging volume on three bases: per product weight, per manufacturer serving, and per standard use amount. The packaging systems that used the least packaging material per amount of product and the packaging systems that used the most packaging material per amount of product were identified. This information lead to the formation of two hypothetical “market baskets”. Market basket 1 contained the packaging systems that used the least amount of packaging per amount of product, and market basket 2 contained the systems that used the most.

The study found that a consumer purchasing a “market basket” containing the packaging systems found in market basket 2 would have 15.2 times more material on a packaging weight per standard use basis and 7.5 times more material on a packaging volume per standard use basis than those items in market basket 1. The study produced numerous comparisons that consumers can use to identify packaging systems that produce the least waste per amount of product in order to reduce the amount of waste material generated in their living environments.

To Frank, Nikki and Darcy

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ACKNOWLEDGMENTS

I am glad I am a Spartan. If I were not, I wouldn't have been exposed to the exceptional people at Michigan State University. These people include the professors, staff, and students whom I have had contact with over the years. I would like to thank all of those who have helped me along the way with this study.

I would especially like to thank the members of my thesis committee, Dr. Susan Selke, Dr. Hugh Lockhart and Dr. Tracy Dobson. Your patience and effort has been exceptional and without your guidance, I would not have been able to complete this study. Thank-you.

I would like to thank the National Consumers' League for sponsoring this study. I enjoyed this project and hope the results will be beneficial to consumers everywhere.

I would also like to thank two students from the Minority Apprenticeship Program who helped me compile some of the data in this study, Ashley Thomas and Kwame Hudson.

I would also like to thank numerous friends for their support throughout my study. I would especially like to thank Laura Bix for her friendship during graduate school. I would also like to thank Ryan, Bill and Jeff for their continued support and encouragement.

Finally, I would like to thank my parents, Frank and Nikki, my sister, Darcy, and my grandparents. Without you this would not have been possible. I will always love all of you for this.

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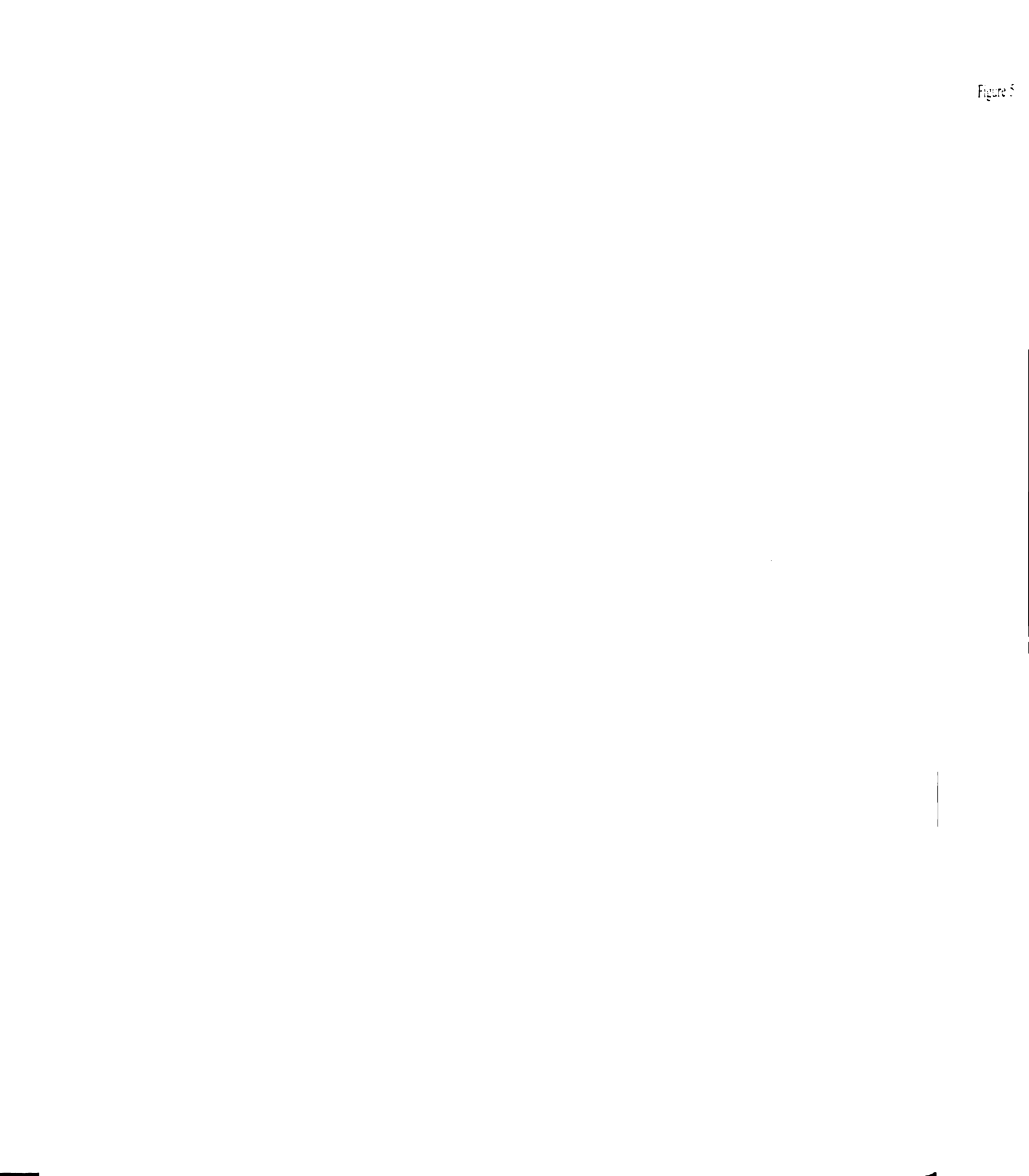


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Chapter 1

INTRODUCTION

Source reduction is a practice that can have a significant impact on waste reduction. This is the process in which the amount of waste generated is reduced at the designing, manufacturing, packaging and purchasing phase of a product. The consumer can apply source reduction practices during the selection phase of purchasing products. In general, source reduction refers to reducing the amount of waste generated at its source.

The purpose of this study was to conduct a comprehensive analysis of reduced packaging for common consumer items found in supermarkets. The analysis was done to provide information about the amount of waste that a packaging system provides after product use. This will act as a guide to the types of grocery item packaging systems that will provide the consumer with the least material to dispose of after product use. The information can also be used by industry to evaluate the amount of material used for their packaging systems.

The approach was to select an array of supermarket product categories representative of consumer purchases; to identify within the categories specific products that are offered in a variety of sizes, modes of preparation, and types of packaging. The study consisted of 40 categories of products, represented by 252 individual products.

Within each product category, a range of products was selected that represented the variety of packaging options available in the supermarket. The objective was to include all combinations of packaging that might result from purchases of product based

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on life style choices not necessarily related to minimizing packaging solid waste. These choices might include economics of price, economics of size (quantity of net contents), dietary considerations, taste preference, etc. Thus, the consumer can know the packaging solid waste impact of most of the purchase choices available.

The amount of packaging for each product was determined. This was, in fact, a determination of the amount of solid waste resulting from each package type, each kind of material, or combination of package type and material. The products were then grouped into two “market baskets”. Market basket 1 is the group of products using the least packaging per delivered unit of product, and market basket 2 is the group of products using the most packaging per delivered unit of product. The packaging solutions in each market basket provide information for consumers as to which packaging systems are associated with the “most” and “least” amount of packaging per delivered unit of product for supermarket products.

The amount of packaging was determined on both a weight basis, and a volume basis. The weight basis is the easier of the two to determine, and is the easier one for most people to visualize. The volume basis refers to the volume of the solid packaging material that surrounds the product. Since the volume determination involves a number of measurements and calculations of different kinds, it must be assumed that this method is less precise than is the weight method, which requires only a single direct weighing of the material.

Once the weight and volume of the packaging components were determined, the calculated weight and volume of packaging material used per unit amount of product was determined. This calculation was made on three different bases: 1) per gram of product

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for solids or per milliliter of product for liquids, 2) per manufacturer's recommended use, and 3) per standard use. The manufacturer's recommended use calculations involve the labeled serving size or use amount of a particular product. The standard use calculation involves a level of "use" that is equivalent for all products in a particular product group. These variables are discussed further in section 3.1. These comparisons were then used to determine the packaging systems that provided the most and the least material per delivered unit of product after product use for each product category.

1.1 Objectives:

The objective of this report is to focus on how consumers can apply this information to purchasing decisions of consumer goods. The findings will be useful in helping consumers purchase products on a "source reduction" basis. This will include examples that consumers can model their interpretations of the data after. The discussion will also focus on how industry can use this information to evaluate packaging systems and components on a per delivered amount of product basis.

This report will also include a discussion of the differences between the volume and weight comparisons made for each product in the original report. The discussion section will also include the differences between the standard use comparison and the manufacturer serving size, the validity of the standard use size used in the comparisons, and the validity of the assumptions made in the study.

This study is to be a companion to the "Reduced Packaging of Consumer Goods" report produced by the Michigan State University School of Packaging for The National Consumers' League. This report was completed in May 1998 and is available from the

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School of Packaging at Michigan State University and The National Consumers League.

Dr. Susan Selke or Dr. Hugh Lockhart can be contacted for further information about the report.

The next chapter presents a review of the literature. Chapter 3 presents the research design of the study; Chapter 4 contains a description of the methodology used in this study. Chapter 5 presents the results and discussion portions of the study. Chapter 6 contains a summary of the study, and suggestions for future research.

Chapter 2

LITERATURE REVIEW

This section presents a review of the literature for this study. The first portion of this section will discuss the current municipal solid waste picture and management strategies in the United States. The second portion will discuss source reduction strategies and practices, and the third will discuss life-cycle assessments. This chapter is written with a focus on the effects of packaging materials in these areas.

2.1 Municipal Solid Waste:

Municipal solid waste is composed of several types of materials including paper and paperboard, yard trimmings, glass, metal, plastics, wood and food wastes. These items can typically be thought of as the wastes that most consumers have contact with on a daily basis. Products found in municipal solid waste are grouped into one of three main categories: durable goods, nondurable goods and containers/packaging. The durable goods category contains no significant amounts of paper or paperboard, the nondurable goods category includes only small amounts of metals, and the container/packaging category contains only small amounts of rubber, leather and textiles. The total amount of municipal solid waste generated in the U.S. in 1996 was 209.7 million tons. The containers/packaging category made up 33.0% of all the municipal solid waste for 1996, approximately 69.2 million tons. The nondurable goods category contained 26.5% (55.7 million tons) and the durable goods category contained 15.5% (31.7 million tons) of all

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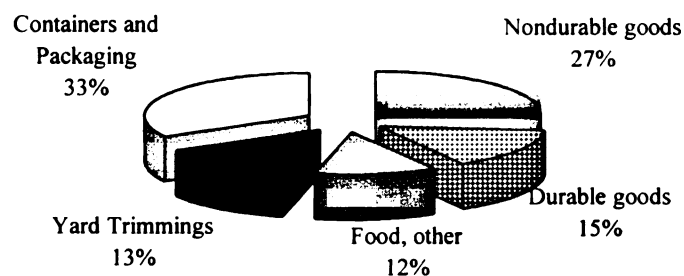
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municipal solid waste. The remainder of the waste can be attributed to food wastes and yard trimmings (see Figure 2.1) (EPA, 1998).



Data from EPA, 1998.

Figure 2.1 Municipal Solid Waste, 1996 (weight percent before recycling).

The containers and packaging category was made up of paper and paperboard, glass, plastics, metals and other materials, mainly wood. Paper and paperboard materials made up 55.6% of the total amount of containers and packaging by weight before recycling. Glass made up 15.9%, plastics accounted for 11.8% and metals made up 7.1% of the total amount of containers and packaging by weight before recycling (see Figure 2.2) (EPA, 1998).

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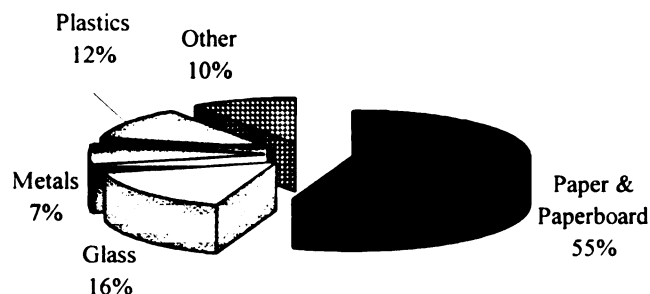
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Data from EPA, 1998

Figure 2.2 Packaging in municipal solid waste, 1996 (weight percent before recycling).

The amount of containers and packaging materials is predicted to increase to 36.5% of the municipal solid waste stream by the year 2000 (American City & County, 1995). This will be mainly due to increased use of plastics in packaging and containers. Plastic packaging had the largest increase in generation for all materials, growing by nearly one million tons, from 18.9 to 19.8 million tons, between 1995 and 1996 (EPA, 1998).

The overall amount of municipal solid waste generated has recently dropped, from a high of 214.2 million tons in 1994. Prior to the downturn, total municipal solid waste generation had increased every year from 88 million tons in 1960 to 214 million tons in 1994 (EPA, 1998). Tonnage is predicted to increase to 218 million tons by the year 2000; however waste amounts entering landfills may be less due to a predicted recovery (recycling) rate of 30% (American City & County, 1995).

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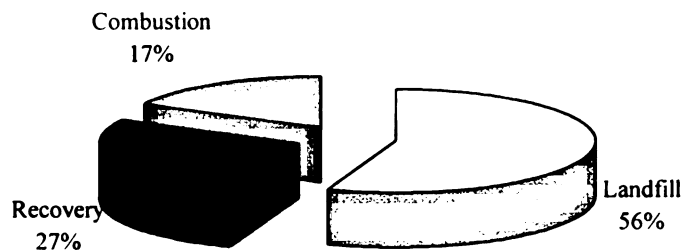
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The EPA produced a solid waste management hierarchy that contains three non-mutually exclusive waste management strategies. The top strategy is source reduction, which is defined as prevention of waste at its source, either by redesigning products or by changing consumption or waste generation patterns. This method will be discussed in further detail later in this chapter. The next strategy is recycling or recovery. This method includes most types of composting. The final, and most widely used, strategy is that of disposal, either through waste combustion, with energy recovery, or landfilling (EPA, 1998).

Landfilling provided 55.5%, 116.3 million tons, of the disposal of municipal solid waste in 1996. Combustion provided 17.2%, 36.1 million tons, and recovery for recycling and composting provided 27.3%, 57.3 million tons. (see Figure 2.3) (EPA, 1998).

Landfilling tonnage has decreased from the early 1990's, but it remains the primary disposal option for a majority of the MSW in the United States. These levels have been decreasing due to increased recovery rates, mainly attributed to increased recycling.

The number of landfills in the United States available for disposal of municipal solid waste has been decreasing in recent years, 8000 in 1988 to 3091 in 1996. The greatest drops were seen in 1993 and 1994, when more than 900 landfills closed each year. The closures in 1993 and 1994 were mainly attributed to the federal Subtitle D regulations that required liner improvements and more stringent site management criteria. The majority of the subsequent closures, however, are due to individual landfills reaching capacity (Goldstein, 1997).



Data from EPA, 1998.

Figure 2.3 Disposal options for municipal solid waste, 1996.

Although the total number of landfills in the United States is decreasing, overall landfill capacity has remained relatively constant. Currently, the Southwest and West regions of the United States have the largest numbers of landfills (EPA, 1998). This is due to the availability of land for landfills in these regions. The Northeast United States has fewer new landfills due to siting difficulties and the lack of available land. The municipal solid waste in the sparsely populated West is more likely to be sent to a landfill than is household waste in the more densely settled Northeast, where land is more scarce (Duda & Shaw, 1997). As landfills in the Northeast close, transfer stations become the primary facility for handling municipal solid waste on a local basis (Goldstein, 1997).

Transfer stations are facilities at which municipal solid waste is processed and prepared for “transfer” to landfills in other states or regions. The number of transfer stations grew to 3123 in 1996. This trend is expected to continue, especially as landfills

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close and waste has to be hauled further distances for disposal. The eastern United States currently reports the highest number of transfer stations, around 1225 (Goldstein, 1997).

The continued growth and reliance on transfer stations in the eastern U.S. could create a situation similar to that of countries in Europe. Most major European cities have difficulty finding suitable sites for landfilling within easy reach of the cities. Some cities, such as Brussels, transport much of their waste more than 100 km for disposal. The lack of landfill sites in these regions has resulted in a need for reduction in waste production and for new methods of disposal. The European Union has required waste reduction strategies that promote more source reduction and recovery and less of a reliance on landfilling, especially for packaging wastes (Levy, Johnson, 1993).

While landfill capacity and reliance remains relatively steady in the U.S., reduction of municipal solid wastes through progressive practices, such as source reduction, will allow for easier waste management decisions in the future. Avoiding waste generation through source reduction decreases the need to develop or expand waste management systems, such as landfills and incinerators, and reduces the controversy of siting new facilities (DeYoung, 1993).

2.2 Source Reduction:

The Environmental Protection Agency has placed source reduction at the top of the solid waste management hierarchy since 1976 (EPA, 1976). Other agencies, such as the Northeast Waste Management Association (NEWMOA), have also ranked source reduction at the top of their waste management hierarchy (Biocycle, 1996). The solid waste management hierarchy consists of three non-mutually exclusive waste management

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Source reduction involves the design, manufacture, purchase, or use of materials, such as products and packaging, in order to reduce their amount or toxicity before they enter the MSW management system (EPA, 1998).

Reducing the toxicity of municipal solid wastes allows for the reduction or complete elimination of contamination problems associated with landfill leachate and with incinerator emissions. The focus of this type of source reduction for municipal solid waste is on household hazardous wastes and heavy metals. The reduction of household hazardous waste involves the diversion of household hazardous wastes from landfills/incinerators to recovery programs. The products typically involved in this type of program include batteries, motor oils and paints. Heavy metal reduction programs function similarly to the household hazardous waste reduction programs, focusing on diverting products containing heavy metals, such as lead and cadmium (Selke, 1994).

Reduction in the amount of waste generated, or source reduction, can be accomplished through four basic approaches: reducing the amount of material used per unit of product, increasing the lifetime of durable and semi-durable goods, substituting

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reusable products for single use products, and directly reducing the amount of goods used by consumers (EPA, 1975).

The reduction in materials is generally thought of as the classical method of source reduction (Selke, 1994). From a packaging perspective, this typically involves reducing the amount of material and/or reducing the energy required to manufacture the packaging system. Minimizing the use of materials and energy is looked at by many manufacturers within the packaging industry as a better strategy for waste reduction than recycling (by itself). Studies indicate reducing the amount of packaging, regardless of the materials used, is an excellent way to minimize wastes (New Zealand Manufacturer, 1996).

This type of source reduction can be accomplished through various activities on the manufacturer level. One way is through a process called “lightweighting”. This involves the reduction of weight and volume of packaging materials used in a packaging system, while preserving its functionality. This typically has occurred and is occurring in packaging systems such as metal cans and plastic and glass bottles (Selke, 1994).

Another method for material reduction on the manufacturer level is through packaging system modifications and/or material changes. This involves modifying existing packaging systems, usually through material changes, so that less materials or energy are needed to provide the packaging function. The development of new plastic materials has resulted in the substitution of lighter packaging materials for heavier materials, such as metals and glass (Selke, 1994). Several manufacturers have developed successful new source reduced packages. For example, Dupont’s Mini-Sip pouches use

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seventy percent less material than individual milk cartons and are now being used to serve milk to over a million school children in Canada (Ottoman, 1995).

Source reduction practices mainly occur at the manufacturer level. Consumers exhibit less source reduction practices due to several reasons including lack of information about source reduction and lack of methods to carry out source reduction activities. The challenge facing officials is how to put the concept of source reduction into practice (for consumers) (Moeger, 1994).

Consumers can apply source reduction in various ways. These activities range from home based activities, such as reusing aluminum foil, to “consumer-based” activities, such as buying items with less packaging. Consumers have been shown to increase their practice of source reduction when an appropriate, low-intensity educational information is provided for their use (DeYoung, 1993).

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2.3 Life Cycle Assessment:

Life cycle assessment (LCA) is the technique designed to evaluate the environmental impact of a product or process. The basis for the methodology is to evaluate inputs and outputs associated with a product or process, throughout its lifecycle, or cradle to the grave (Selke, 1994). The Society of Environmental Toxicology and Chemistry (SETAC) defines life cycle assessment in the following way:

“The life-cycle assessment is an objective process to evaluate the environmental burdens associated with a product, process or activity by identifying and quantifying energy and material uses and releases on the environment, and to evaluate and implement opportunities to effect environmental improvements. The assessment includes the entire life cycle of the product, process, or activity, encompassing extracting and processing raw materials: manufacturing; transportation, and distribution; use/re-use/maintenance; recycling and final disposal.” (SETAC, 1991).

Life cycle assessments have roots as far back as 1960, when they were used to evaluate energy use by various systems. Life cycle assessments, through time, have progressed into other subjects, such as solid waste issues and air and water emissions (SETAC, 1991). Packaging material studies represent one of the most important application fields of LCA. It is estimated that in the period between 1970 and 1992, more than 40% of the publicly available LCA studies concerned packaging materials (Knoepfel, 1994).

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Life cycle assessments, however, varied in scope and methodology during a majority of this time period. Problems existed when comparing various environmental impacts, such as comparing water effluents to air effluents, due to the inclusion of value judgements (Selke, 1994).

It was due to problems like these that SETAC held a workshop in 1990 to evaluate and to define terms to describe life cycle assessments. The workshop produced the framework for how life cycle assessments are carried out today. The key finding of the 1990 workshop was to define life cycle assessment as a phased approach. This approach featured three interrelated components, the life cycle inventory, the life cycle impact analysis, and the life cycle improvement analysis (Curran, 1996).

The life cycle inventory consists of an objective process of quantifying the inputs and outputs incurred throughout the life cycle of a product, process, or activity. The life cycle impact analysis is a technical, quantitative and/or qualitative process to characterize and assess the effects of the inputs and outputs identified in the inventory component. “The life cycle improvement analysis is a systematic evaluation of the needs and opportunities to reduce the environmental burden associated with energy and raw materials use and waste emissions throughout the whole life cycle of a product, process or activity.” This includes both quantitative and qualitative measure of processes and activities, such as waste management and consumer use (SETAC, 1991).

The workshop also agreed that most life cycle assessments that had previously been done consisted primarily of only the life cycle inventory component. The workshop participants also pointed out that there was a need for development of the life cycle impact analysis and of the life cycle improvement analysis components (Selke, 1994).

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Life cycle improvement assessment often is born from the desire to reduce burdens on the environment by altering a product or process. Another driver for life cycle improvement assessments has been the desire to benchmark a product against competitive products or to prove that one product is environmentally preferable to another. These types of improvement assessments are designed to assist individuals or companies in making more environmentally sound choices (Curran, 1996).

3.1 Conclusion

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Chapter 3

RESEARCH DESIGN

3.1 Conceptual Model:

The purpose of this study was to gather information on the solid waste impacts of consumer packages found in grocery stores. The study was specifically designed to compare the source reduction aspects of each consumer package. The study included 40 product categories, containing 252 product/package systems. The weight and volume of the packaging components and the weight of the product were measured for each product in the study. This was, in fact, a determination of the amount of solid waste resulting from each package type, kind of material, or combination of package type and material. This provided the weight and volume of the packaging components individually, which then were combined to give the total weight and volume for the entire packaging system. From this, the weight and volume of packaging material used per unit amount of product was determined. These calculations were done on three different bases: 1) per gram of product for solids or per milliliter of product for liquids, 2) per manufacturer's recommended use, and 3) per standard use. A discussion of these bases is as follows:

Per gram or per milliliter - This provides a fundamental product based standard for comparison.

Per manufacturer's recommended use - Foods, especially, and some other products as well, carry a manufacturer's recommendation for the amount that

constitutes a “use” or serving. Probably most consumers use this recommendation as a starting point for their use behavior. The Food and Drug Administration and the U. S. Department of Agriculture have developed a great deal of tabulated data on the “serving size” for many foods. The study assumed the manufacturer’s recommendation for number of servings for foods is based on data developed by the government agencies, or on data of equal validity developed by themselves.

Per standard use (food) - Consumers adjust the amount they use for a serving, at least part of the time. It is also true that the recommended serving size varies in nutritional value, such as calories. For this reason, a “standard use”, or “standard serving” was established that uses 100 calories as the basis. To accomplish this, the calorie count given by the manufacturer was used to recalculate a serving size based on a calorie count of 100. Thus, if the manufacturer’s serving is 100 grams with 130 calories, the “standard serving” of 100 calories would be 77 grams.

Per standard use (other than food) - Many non-food products do not have a manufacturer’s recommended number of uses, or quantity of product to be used for a single use. For these, a standard use was established, based on an ad hoc study among the thesis committee members to measure a reasonable use size. While this was not done by any designed experiment with proven validity over all consumers, it was done in an unbiased manner. The determined value was used

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The products were then grouped into two “market baskets” consisting of representative packaging systems for each product category. Market basket 1 is the group of products using the least packaging, and market basket 2 is the group of products using the most packaging per delivered unit of product. These “baskets” were used to determine which packaging systems were associated with the most and the least amount of packaging per delivered unit of product for supermarket products. For almost all product categories, the “most packaging used” or “least packaging used” selection was the same for both volume and weight determinations. For a few categories, the selection would be different for the volume determination than for the weight determination. When this happened, the assignment was based on the weight determination because it is the more reliable of the two, as described in 3.1.1.

3.1.1 Model Assumptions and Exclusions:

The amount of packaging was determined on both a weight basis, and a volume basis. The weight basis is the easier of the two to determine, and is the easier one for most people to visualize. The volume basis refers to the volume of the solid packaging material that surrounds the product. For some materials and packages, such as paper wraps, was determined by measuring the length, width and thickness of the material, and then calculating the volume for other materials and packages, such as plastic bottles. The volume of material (plastic) was determined by measuring the amount of water displaced

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by the bottle emptied of product, or by measuring the actual area and thickness of the bottle to get a volume. Since the volume determination involves a number of measurements of different kinds, it must be assumed that this method is less precise than is the weight method that requires only a single direct weighing of the material. The volume of the material is of interest to some researchers now, and it may become of greater interest in the future. Therefore, it was included in the study.

This study focussed only on the retail packaging of a product. This study did not include information about the packaging required for distribution of the retail products. In some cases, less packaging for the consumer to take home means more packaging is required for safe distribution of the product. No attempt was made to examine the effects of retail packaging on distribution packaging.

This study did not include variables related to product quality and shelf life. A minimal package, while functioning properly, might result in reduction in the quality of the product, which could lead to an increase in the discard rate for the product/packaging system. A more substantial packaging system could prolong the quality of the product thereby reducing the discard rate of the product/packaging system.

This study did not evaluate the recyclability of the packaging material, use of recycled content, compostability, or energy value of the disposed materials.

Finally, this study did not examine factors related to pollutants emitted during manufacturing processes, energy consumption during manufacturing or distribution, product (and package) waste associated with damage during distribution, impacts associated with disposal of the packages, and other such factors.

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3.2 Product Category Selection:

The product categories were selected from the Nielsen Product Category List. This list consists of the 40 most purchased consumer items in a supermarket environment. Table 3.1 shows the product categories that were selected for use in this study. Each product category was discussed before final inclusion in the study. This was done to ensure that the products from the category were available in markets in the Lansing, Michigan area. The discussion also provided the opportunity to discuss the validity of each product group in the study. The Nielsen Product Category List varied as to the scope of each product category. Some product categories were found to be broad and therefore required that a specific product type be selected for analysis. The Tuna Fish Product Category is an example of this type of category. The Nielsen Product Category List entry for this type of product was seafood. This proved to be too broad of category and was therefore narrowed to tuna fish, a type of seafood.

Other product categories needed to be combined since the product being selected by the consumer was the “same”. Some product categories in the Nielsen Product Category List were found to be actually subcategories of the same product type. These product subcategories were combined since the product was the same. An example of this is found in the juice category. The Nielsen List had subcategories of frozen juice, refrigerated juice and bottled juices. These subcategories were combined into the category of Juice for the purposes of this study. This was done because the same product, in this case juice, is delivered to the consumer regardless of the subcategory.

The dish detergent category was split into two subcategories in this study. This was because the product category consisted of two different product types, hand dish

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soaps and automatic dishwasher soaps. This category was split into these two sub-categories for comparison purposes, since hand dish soaps cannot be used in automatic dishwashers.

Table 3.1 Product Categories

Baby Food	Laundry Detergent
Baking Mix	Lunch Meat
Beer	Margarine
Bread	Meat
Candy	Milk
Cereal	Paper Towel
Cheese	Pasta
Chips	Pet Food
Cleaners	Poultry
Cookies	Shampoo
Crackers	Soft Drink
Dinners	Soup
Dishwashing Detergent	Tissues
Drink Mix	Toilet Paper
Eggs	Tomato Product
Fruit	Toothpaste
Gum	Tuna Fish
Hand Soap	Vegetables
Ice Cream	Water
Juices	Yogurt

3.3 Product Selection Criteria:

The products within each product category were selected to provide the widest variety of packaging options in each category. Each product was evaluated only on the retail packaging components. The products were selected into the corresponding product

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category in one of two ways. The first selection method was for products that exhibited a unique packaging system within the product category. These packaging systems were selected into the product category. The second selection method was for products with packaging systems that were common among products within a particular category. These packaging systems were selected on a size or quantity basis. In these cases, the packaging system did not vary amongst the products, but the size of the package and quantity of product varied. In these instances, three product sizes were selected to represent the particular packaging system. The three sizes used were a single serving or small size, a medium or regular family size, and a large or economy size product. These were the two selection criteria for packaging systems in the study.

The product/packaging systems were selected on a random brand basis for the study. Selection, as stated above, was based solely on a packaging basis. No specific brand was targeted to comprise each product category.

The product categories were composed of samples from every applicable form of product available. This included products that were frozen, shelf-stable, fresh and refrigerated. The study was limited to these forms of products and limited to only those products available in grocery stores.

Section 5.2 contains the data for every product group and a description of the specific product type that comprises the product category. Appendix B contains a description of each packaging system that was accepted into each particular product category.

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3.4 Packaging Preparation Criteria:

The products that were selected in each product category underwent a series of preparation techniques for data acquisition. The first procedure was the cataloging of the individual product into the packaging materials database. Each individual product was given a number that would be the identification for that product's components for the remainder of the study. The product was then removed from the packaging for weighing or measuring. The packages were manipulated with extreme care during this procedure in order to leave the packaging components in as pristine condition as possible.

The packaging components were then separated based on material. The separation criteria were based upon the general properties and/or form of the packaging components. This involved placing each packaging component, such as paperboard carton, plastic film over-wrap, and plastic bottle, into a separate location. At this point, each component was labeled with the same number as the product.

The packaging components were then "knocked down" or cut open, depending on the material. This involved manipulating the packaging components into a "flat" form, from which area measurements, thickness measurements and weights could be made. Some rigid packages, such as plastic bottles and glass bottles, were not cut open. These components were left in their original configuration.

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Chapter 4

METHODOLOGY

This chapter will focus on the materials used and procedures used during the data acquisition portion of the study. This section includes a discussion of the methods used to calculate the weight and volume of the packaging materials. Units of measurement are also discussed.

4.1 Units of Measurement:

Metric units were chosen for use in this study. Working in metric provided more accurate measurements and numerical analysis. Conversions from metric to any other system can be done with a few simple conversion calculations, and since the data can be used in many arenas, the most accuracy and convenience are preserved in the metric approach.

Conversion to units that are better understood by American shoppers is not difficult. Amounts reported as grams per 100 g of product (standard use basis) are identically ounces per 100 ounces of product or lbs. per 100 lbs. of product. A calculation is required for amounts reported as grams per 100 ml of product. In that case, multiplying by 0.0688 will give lbs. per 100 fl oz of product.

4.2 Materials/Equipment:

The essential materials used in this study were the packaging material and to a lesser extent, the products. The packaging components were prepared as described in section 3.4 and were measured for volume and weight. The products were removed from the packages and weighed. These processes required the use of several pieces of standard

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equipment. These included a gram scale, a digital micrometer, a metric ruler, a graduated cylinder, and a fish tank (for volume measurements). A computer spreadsheet program was also used to record data.

A Mettler PM 2000 gram scale was used to weigh the product, and the packaging materials, to 0.01 grams.

A Mitutoyo Digimatic Micrometer series 293 was used to measure thickness to in millimeters to a position of 0.001 millimeter with a maximum distance of 25.4 millimeters. This was the place that was used in this study, since thickness accuracy was deemed important. The thickness was measured in millimeters, but was reported in centimeters.

A Wescott flexible ruler was used to measure the length, and width of the packaging materials to 0.1 cm.

A graduated cylinder was used to measure the volume of liquid products. This information was used instead of product weights for these items. The graduated cylinder measures volumes of liquids in milliliters. Three sizes of graduated cylinders were used, a 1000-milliliter cylinder measuring to the nearest 10 ml point, and a 250-ml cylinder measuring to the nearest 2 ml, and a 100-ml cylinder measuring to the nearest milliliter

The fish tanks were used for measuring the volume of packaging material for some rigid containers, such as glass bottles or large steel cans that could not be measured through the area x thickness method. This was achieved by measuring the amount of water displaced by the empty bottle. Three sizes of fish tanks, 10-gallon, 15-gallon and 25-gallon tank, were used for the various sizes of packages encountered.

The computer software that was used for data recording was Microsoft Excel '97 and Quattro Pro Version 6.0 for Windows.

4.3 Data Acquisition Procedures:

4.3.1 Laboratory Book Set-up:

Identification numbers were assigned to each product that corresponded to the laboratory book page the data was entered on. The number was affixed, with permanent marker, to the surface of each packaging material component. After the numbering phase, specific information about the products used in the study was recorded:

Product Category:
Product Brand Name:
Product Manufacturer:
Date Purchased, Store, Price of Item:
Labeled Weight of Product (oz, g, ml):
Labeled Serving Size (oz, g, ml):
Labeled Servings per Container (oz, g, ml):
Measured Weight of Product (g, ml):
Packaging Weight(s) (g):
Packaging Material(s) Thickness (cm):
Packaging Material(s) Surface Area (cm²):
Packaging Material(s) Volume (cm³):
Description of Packaging:
Additional Information:

The information recorded varied with the product type. Solid products, as mentioned, were weighed, while the volume of liquid products was recorded. The measuring of the packaging materials areas and/or volumes varied depending on the rigidity of the packaging system. Some rigid liquid containers were unable to be “knocked down”, and therefore were measured using volume displacement. In these instances, the packaging material surface area and thickness categories were left blank. The packaging description required a detailed listing of the packaging components comprising the packaging

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4.3.2 Information Gathering Procedures:

The data for the product category, product brand name, product manufacturer, labeled weight, labeled serving size, and labeled servings per container were obtained from the package. The date of purchase, item price and purchase location information was obtained from the sales receipt.

The next step was the measuring of the product weight. This was accomplished in the following manner. All product was removed from the packaging system and was placed into a separate ziploc style bag. Prior to product introduction, each bag was weighed so that the weight of the bag could be subtracted from the overall weight of the product. The bags of product were then weighed on the gram scale and the weights were recorded, less the weight of the bag.

Liquid products were measured in a graduated cylinder. Three sizes of graduated cylinder were available for this procedure. The graduated cylinder selected for use depended on the amount of product that was going to be measured. For smaller liquid product amounts, the smaller size was used, and for more product, a larger graduated cylinder was used. The product was poured into the cylinder and given a chance to settle before measurement.

The packaging components were then weighed on the Mettler gram scale. Each packaging component was weighed separately during this phase. The weight of each

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packaging component was measured and recorded. The cumulative total for the components was calculated and entered as the packaging system weight.

The thickness of each packaging component was determined through use of the Mitutoyo Digital Micrometer. This instrument is a hand held unit that measures the thickness of items less than 25.4 mm (1 inch) in thickness. The sample is installed in the unit, and the dial/handle of the unit is rotated so that the instrument closes on the sample. Each component of the packaging system was measured in three random places. These measurements were averaged to give the mean thickness for the packaging component.

The next step was to measure the surface area of the individual packaging component for packaging systems that could be “knocked down”. Examples of these types of packaging systems included flexible packages and paperboard cartons. These packages were “knocked down” and the components were separated to allow for ease in measurement. The length and width of each packaging component was measured, in centimeters, using the Wescott flexible ruler. These measurements were used to calculate the surface area, in cm^2 , and the material volume, in cm^3 .

For rigid packaging systems, such as some plastic bottles or glass bottles, a volume displacement method was used to determine the volume of packaging material in each packaging system. The system consisted of a glass rectangular fish tank, water, and a fixed ruler for measuring water height. The internal dimensions of the fish tank, length and width, were measured, in centimeters, prior to introduction of the water. The water level was set to a certain height and measured in centimeters before the package was submerged. This provided the initial volume of the water in the fish tank. The packaging system was then introduced into tank and was submerged in the water. To evacuate

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trapped air, a small hole was created in each rigid container. The water level was then measured again and the volume of the entire system, water and package, was determined. The difference between the final system volume and the initial water volume is the amount of water displacement, or the volume of package material in the system.

This data was then entered into a computer spreadsheet program for calculation of the manufacturer serving comparisons, the standard use comparisons and product weight comparisons. The spreadsheets also calculated the packaging component volumes and the cumulative total packaging system value to verify the values previously recorded.

4.4 Comparison Calculations:

The comparisons for each packaging system in the study were calculated through the use of computer spreadsheet programs. Two types of comparisons were made, based either on the packaging weight, or the volume of packaging material. A description of each comparison will follow later in this section. The comparisons are as follows:

Volume of Packaging per Manufacturer Serving
Volume of Packaging per Standard Use
Volume of Packaging per Product Weight
Packaging Weight per Manufacturer Serving
Packaging Weight per Standard Use
Packaging Weight per Product Weight

The volume of packaging per manufacturer serving comparison was based upon the labeled manufacturer number of servings found in the nutritional information table on the packaging. The serving amount varied among products, depending on the type of product, the amount of product and the caloric content of the product. This calculation

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was carried out for all products that had a manufacturer serving size available. Results were reported in units of $\text{cm}^3/\text{serving}$.

The volume of packaging per standard use comparisons was based upon the standard use basis of 100 calories per serving for foods. Other products, such as laundry detergent, were compared using a different basis for the standard use amount. The products for which this applied are discussed in section 5.5.1. Results were reported in units of cm^3/use .

The volume of packaging per product weight comparison was based upon the actual amount of the product, either grams or milliliters, contained in the package. Results were reported in units of cm^3/gram for solid products and cm^3/ml for liquid products.

The packaging weight per manufacturer serving comparison was based upon the labeled manufacturer number of servings found in the nutritional information table on the packaging. The packaging weight was the physical weight of all packaging components found in a particular packaging system. Results were reported in units of grams/servings.

The packaging weight per standard use comparison was based upon the standard use basis of 100 calories per serving of product. As mentioned before, this was the standard use amount used for a majority of the food products. Other products were compared using different standard use amounts. Results were reported in units of grams/use.

The packaging weight per product weight comparison was based upon the actual amount of the product, either grams or milliliters, contained in the package. Results were reported in units of gram/gram or gram/ml, depending on the type of product.

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Chapter 5

RESULTS AND DISCUSSION

This section contains the data for this study. Section 5.1 presents the summary data for this study, and section 5.2 contains the comparison data for every product group in the study. This portion of the report also contains a description of the least and most packaging system for each product group. The remaining sections discuss the objectives of the study, provide some data interpretation, and discuss various observations found during the study.

5.1 Packaging Comparative Data:

The study compared the amount of packaging material used on a volume and weight basis for 40 product groups containing 252 products. The data collected on each product category allowed for the selection of the packaging option that used the least material and the one that used the most material, per unit amount of product. In Table 5.1, the products that used the least materials are grouped in market basket 1. The products that used the most materials are grouped in market basket 2. The table also shows a comparison of the ratio of the total material associated with one unit amount of each product using the packaging alternatives in the two market baskets. The table shows that the products comprising market basket 1 used markedly less packaging material than the products in market basket 2. The volume of packaging material per use in market basket 2 was 7.5 times the volume in market basket 1. The packaging weight per use in market basket 2 was 15.2 times the weight in market basket 1. The volume of packaging per gram of product and the packaging weight per gram of product were 4.1 and 5.7

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times, respectively, as large in market basket 2 as in market basket 1. The comparisons based on the number of uses or servings are the most relevant in educating consumers to make choices that reduce generation of packaging waste. The data shows that consumers can reduce waste generation by purchasing items from the least packaging materials group rather than purchasing items from the most packaging materials group. Figure 5.1 presents this data in a bar chart.

Table 5.2 depicts the packaging weight comparisons for the least material and most material packaging systems for each product group, and Table 5.3 shows the packaging volume comparisons. The values from Tables 5.2 and 5.3 were combined to create market basket 1 and 2 seen in Table 5.1 and Figure 5.1.

Table 5.1 Comparison of Market Basket 1 to Market Basket 2

	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer Serving g/serving	Packaging Weight/ Standard Use g/use	Volume Packaging/ Manufacturer Serving cm ³ /serving	Volume Packaging/ Standard Use cm ³ /use	Volume Packaging/ Product Weight cm ³ /g
Market Basket 1	2.1	82.3	72.6	96.4	87.8	2.4
Market Basket 2	11.9	1100.5	1104.2	724.7	656.8	9.8
Ratio of Market Basket 2 to Market Basket 1	5.7	13.4	15.2	7.5	7.5	4.1

Figure 5.1 Comparison of Market Basket 1 to Market Basket 2

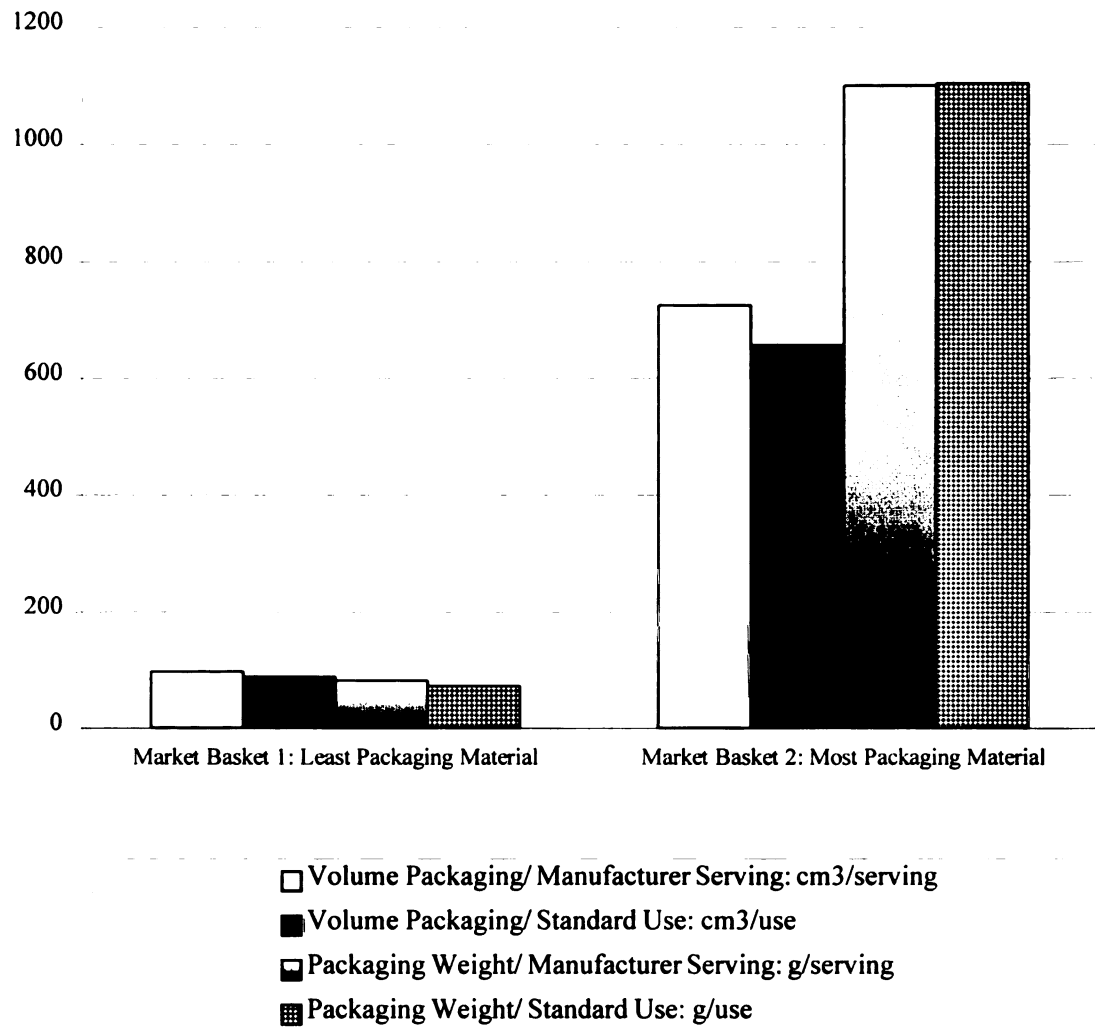


Table 5.2 Least and Most Packaging Materials: Weight Comparisons

Product Category	Market Basket 1 Least Packaging Material			Market Basket 2 Most Packaging Material		
	Packaging Weight/ Manufacturer serving	Packaging Weight/ Standard Use	Packaging Weight/ Product Weight	Packaging Weight/ Manufacturer serving	Packaging Weight/ Standard Use	Packaging Weight/ Product Weight
	g/serving	g/use	g/g	g/serving	g/use	g/g
Baby Food	2.350	3.440	0.147	9.860	12.860	0.735
Baking Mix	0.261	0.194	0.015	6.460	4.516	0.143
Beer	16.000	16.205	0.045	267.698	254.187	0.702
Bread	0.499	0.589	0.017	0.573	0.633	0.018
Candy	2.430	1.191	0.064	6.524	3.376	0.189
Cereal	0.727	0.624	0.023	17.474	14.255	0.548
Cheese	0.322	0.286	0.011	55.080	57.503	1.848
Chips	0.962	0.593	0.034	7.732	4.761	0.272
Cleaners	2.932	2.728	0.091	4.309	4.127	0.070
Cookies	0.675	0.402	0.017	5.192	8.196	0.273
Crackers	0.225	0.374	0.015	2.402	3.764	0.151
Dinners	6.508	2.451	0.091	65.970	19.809	0.184
Dishwashing Detergent-Auto ¹	-	2.889	0.052	-	3.204	0.057
Dishwashing Detergent-Hand ¹	-	0.290	0.047	-	0.430	0.069
Drink Mix	0.223	0.234	0.385	3.153	3.198	0.186
Eggs	1.304	1.646	0.023	4.042	5.028	0.070
Fruit	0.662	0.877	0.004	56.997	82.185	0.457
Gum ²	0.444	-	0.098	0.957	-	0.385
Hand Soap ¹	-	0.043	0.021	-	1.170	0.234
Ice Cream	3.641	1.339	0.034	3.748	2.452	0.053
Juices	4.362	1.339	0.018	80.096	79.680	0.332
Laundry Detergent	0.432	0.427	0.007	19.323	18.830	0.156
Lunch Meat	0.438	1.036	0.015	6.570	10.461	0.110
Margarine ²	0.650	-	0.045	1.803	-	0.121
Meat	1.234	0.366	0.009	4.273	2.029	0.034
Milk	1.550	1.307	0.007	22.768	17.612	0.095
Paper Towel	0.035	0.077	0.015	0.151	0.180	0.099
Pasta	0.305	0.146	0.005	8.380	3.458	0.094
Pet Food ¹	-	1.369	0.022	-	35.157	0.227
Poultry	0.309	0.219	0.003	1.443	1.050	0.017

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Shampoo	0.501	0.811	0.081	1.050	1.615	0.162
Soft Drink	6.419	6.461	0.027	232.797	231.510	0.965
Soup	1.955	1.675	0.059	105.177	93.276	0.454
Tissues	0.230	0.435	0.034	0.714	1.438	0.091
Toilet Paper	0.004	0.027	0.098	0.016	0.113	0.068
Tomato Product ²	0.895	-	0.052	1.305	-	0.074
Toothpaste	0.170	0.156	0.099	2.202	2.006	1.276
Tuna Fish	12.852	10.640	0.181	47.945	54.009	0.569
Vegetables	0.320	0.882	0.004	15.735	50.758	0.127
Water ²	4.057	-	0.015	16.159	-	0.056
Yogurt	5.390	8.853	0.042	14.459	15.344	0.081
TOTALS	82.273	72.621	2.071	1100.537	1104.180	11.852

¹ The packaging weight per manufacturer serving comparison was not done for the dishwashing detergent, hand soap and pet food categories since no manufacturer serving/use information was available on the packages.

² The packaging weight per standard use comparison was not done for the gum, margarine, tomato product and water categories. This is due to the product not having nutritional value or being used as flavoring instead of as a source of nutrition. Detailed information regarding standard use levels is presented in section 5.4.

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Table 5.3 Least and Most Packaging Materials: Volume Comparisons

Product Category	Market Basket 1			Market Basket 2		
	Least Packaging Material			Most Packaging Material		
	Volume Packaging/ Manufacturer serving cm ³ /serving	Volume Packaging/ Standard Use cm ³ /use	Volume Packaging/ Product Weight cm ³ /g	Volume Packaging/ Manufacturer serving cm ³ /serving	Volume Packaging/ Standard Use cm ³ /use	Volume Packaging/ Product Weight cm ³ /g
Baby Food	2.347	3.431	0.147	6.980	9.154	0.523
Baking Mix	0.030	0.022	0.001	5.580	3.900	0.124
Beer	7.700	7.799	0.022	148.370	140.882	0.389
Bread	0.535	0.632	0.018	0.509	0.562	0.016
Candy	2.165	1.061	0.057	9.079	4.698	0.263
Cereal	2.639	2.265	0.083	20.114	16.409	0.629
Cheese	0.215	0.191	0.007	29.542	30.842	0.991
Chips	1.113	0.686	0.039	10.640	6.552	0.374
Cleaners	3.633	3.380	0.113	4.828	4.624	0.078
Cookies	1.431	0.427	0.018	12.545	19.803	0.680
Crackers	0.207	0.344	0.014	2.821	4.421	0.177
Dinners	7.099	2.673	0.099	69.417	20.844	0.194
Dishwashing						
Detergent-Auto ¹	-	2.792	0.050	-	3.423	0.061
Dishwashing						
Detergent-Hand ¹	-	0.219	0.035	-	0.257	0.042
Drink Mix	0.209	0.220	0.361	1.651	1.674	0.097
Eggs	18.118	22.871	0.320	9.986	12.423	0.174
Fruit	0.530	0.702	0.003	18.223	26.277	0.146
Gum ²	0.359	-	0.079	1.070	-	0.385
Hand Soap ¹	-	0.041	0.019	-	1.046	0.209
Ice Cream	4.248	1.562	0.040	4.662	3.050	0.066
Juices	4.398	4.370	0.018	38.808	38.604	0.161
Laundry	0.406	0.401	0.006	12.271	11.958	0.099
Detergent						
Lunch Meat	0.373	0.881	0.013	6.884	10.960	0.115
Margarine ²	0.784	-	0.055	1.720	-	0.115
Meat	13.342	3.954	0.094	33.777	16.039	0.270
Milk	1.621	1.366	0.007	21.482	16.617	0.090
Paper Towel	0.037	0.081	0.015	0.162	0.193	0.106
Pasta	0.582	0.278	0.010	6.316	2.606	0.071
Pet Food ¹	-	4.278	0.069	-	5.239	0.034
Poultry	0.348	0.246	0.004	11.733	8.536	0.136
Shampoo	0.387	0.626	0.063	1.109	1.706	0.171
Soft Drink	5.257	5.291	0.022	140.212	139.438	0.581

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Soup	1.798	1.540	0.055	33.749	29.930	0.146
Tissues	0.208	0.393	0.030	0.904	1.821	0.116
Toilet Paper	0.004	0.030	0.109	0.015	0.102	0.061
Tomato Product ²	0.660	-	0.038	0.971	-	0.055
Toothpaste	0.219	0.202	0.128	2.385	2.173	1.382
Tuna Fish	3.020	2.500	0.042	27.083	30.509	0.321
Vegetables	0.334	0.921	0.004	4.472	14.425	0.036
Water ²	4.509	-	0.017	10.389	-	0.036
Yogurt	5.524	9.073	0.044	14.274	15.147	0.080
TOTALS	96.389	87.749	2.368	724.733	656.844	9.800

¹ The volume of packaging per manufacturer serving comparison was not done for the dishwashing detergent, hand soap and pet food categories since no manufacturer serving/use information was available on the packages.

² The volume of packaging per standard use comparison was not done for the gum, margarine, tomato product and water categories. This is due to the product not having nutritional value or being used as flavoring instead of as a source of nutrition. Detailed information regarding standard use levels is presented in section 5.4.

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Table 5.4 provides a description of the packaging systems included in Tables 5.2 and 5.3. The packaging systems that most often appeared in market basket 1 included paper/plastic/foil laminate pouches, single low-density polyethylene (LDPE) bags, polyethylene terephthalate (PET) bottles, and plastic pouches. Market basket 2 was primarily composed of packages that used multiple components in the packaging system. These systems include paperboard cartons with internal plastic sealed bags, amber and clear glass jars with paper labels, expanded polystyrene tray (PS) with plastic wrap, and corrugated boxes with plastic/foil pouches inside.

Table 5.5 provides a comparison of market basket 1 to market basket 2 using the packaging weight per standard use comparison. The packaging weight per standard use comparison was selected for this table based on the belief that it was the most relevant comparison used in the study, as previously mentioned. For the gum, margarine, tomato product and water product categories the packaging weight per manufacturer serving comparison was used. This was due to the packaging weight per standard use comparison not being done for these categories. The reasoning for this varies depending on the product group. The individual reasoning for each product groups affected in this manner is discussed in section 5.2.

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Table 5.4 Packaging System Descriptions

Product Group	Market Basket 1: Least Packaging Material Packaging Description	Market Basket 2: Most Packaging Material Packaging Description
Baby Food	Paper/plastic/foil laminate pouch	Clear glass jar, metal lid, paper label
Baking mix	Plastic pillow pouch	Paperboard box, 2-piece steel can, plastic pouch
Beer	6 aluminum cans, plastic ring holder	Paperboard carton, 6 amber glass bottles
Bread	LDPE plastic bag, inner plastic wrap	LDPE plastic bag, inner plastic wrap
Candy	Plastic pillow pouch, foil wrap, paper cup	LDPE plastic bag, paperboard backing, plastic wraps
Cereal	LDPE plastic bag	8 paperboard boxes, 8 plastic bags, outer plastic wrap
Cheese	Plastic pillow pouch	Ceramic jar, metal closure, inner plastic pouch
Chips	Plastic/paper laminate bag	Paperboard tube, paper/plastic/foil seal, HDPE plastic lid
Cleaners	HDPE plastic bottle	HDPE bottle
Cookies	Plastic/foil laminate pillow pouch	Paperboard carton, plastic/foil laminate pouch, PS tray
Crackers	LDPE plastic bag	Paperboard carton, plastic pouches
Dinners	Paperboard carton, Plastic/foil/paper laminate pouch	Paperboard carton, EPS tray, Paper tray, plastic wrap
Dish Soap, hand	HDPE plastic bottle	PET bottle
Dish Soap, auto	HDPE plastic bottle	Paperboard box, plastic/foil laminate outer wrap
Drink Mix	Plastic/foil laminate pouch	Paperboard tube, HDPE lid, metal lid and bottom
Eggs	EPS foam carton	Pulpboard carton
Fruit	Plastic mesh bag, paper label	Clear glass jar, metal lid
Gum	Plastic outer bag, 4 plastic/foil wraps, paper gum wraps	Paperboard sleeve, plastic blister pack, foil seal
Hand Soap	Plastic outer wrap, 3 plastic/foil laminate wraps	Paperboard outer carton, PET plastic bottle
Ice Cream	HDPE plastic tub	Paperboard carton, plastic lid
Juice	Paperboard tube, metal top and bottom	Clear glass bottle, metal cap
Laundry Detergent	Plastic bag	HDPE bottle
Lunch meat	LDPE plastic pouch	Paperboard carton, plastic pouch
Margarine	Paperboard carton, 4 paper wraps	HDPE plastic bottle
Meat	EPS tray, plastic wrap	EPS tray, plastic film cover, laminated

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Milk	LDPE plastic pouch	plastic film covering 6 HDPE pigmented bottles, plastic outer wrapping
Paper Towel	LDPE plastic wrap	8 LDPE plastic wraps, outer plastic wrap
Pasta	Plastic pillow pouch	EPS tray, plastic wrap
Pet Food	Plastic/paper laminate bag	2-piece steel can, paper label
Poultry	LDPE bag	EPS tray, plastic wrap
Shampoo	PET bottle	HDPE bottle
Soft Drink	PET bottle	Paperboard carton, 6 clear glass bottles
Soup	Paper/plastic/foil laminate pouch	Clear glass jar, metal cap, paper label
Tissues	Plastic outer wrap, 8 plastic tissue wraps	Paperboard box, plastic wrap
Toilet tissue	LDPE plastic wrap	LDPE plastic wraps
Tomato Product	PET bottle	Plastic bottle
Toothpaste	Plastic self-standing tube	Paperboard box, plastic molded pump
Tuna Fish	2-piece steel can, paper label	Paperboard carton, 3 PET cups, 3 2-piece steel cans
Vegetables	LDPE bag	2-piece steel can, paper label
Water	HDPE plastic bottle	Paperboard carton, 4 PET plastic bottles
Yogurt	6 plastic cups, plastic/foil laminate seal	PS tray, plastic/foil laminate seal

Table 5.5 Comparison of Packaging Weight/Standard Use for Market Basket 1 & 2

Product Group	Market Basket 1 Packaging Weight/ Standard Use g/use	Market Basket 2 Packaging Weight/ Standard Use g/use	Ratio Basket 2 to Basket 1
Baby Food	3.440	12.860	3.74
Baking mix	0.194	4.516	23.28
Beer	16.205	254.187	15.69
Bread	0.589	0.633	1.07
Candy	1.191	3.376	2.83
Cereal	0.624	14.255	22.84
Cheese	0.286	57.503	201.06
Chips	0.593	4.761	8.03
Cleaners	2.728	4.127	1.51
Cookies	0.402	8.196	20.39
Crackers	0.374	3.764	10.06
Dinners	2.451	19.809	8.08
Dish Soap, hand	0.290	3.204	11.05
Dish Soap, auto	2.889	0.430	0.15
Drink Mix	0.234	3.198	13.67
Eggs	1.646	5.028	3.05
Fruit	0.877	82.185	93.71
Gum ¹	0.444	0.957	2.16
Hand Soap	0.043	1.170	27.21
Ice Cream	1.339	2.452	1.83
Juice	4.334	79.680	18.38
Laundry	0.427	18.830	44.10
Detergent			
Lunch meat	1.036	10.461	10.10
Margarine ¹	0.650	1.803	2.77
Meat	0.366	2.029	5.54
Milk	1.307	17.612	13.48
Paper Towel	0.077	0.180	2.34
Pasta	0.146	3.458	23.68
Pet Food	1.369	35.157	25.68
Poultry	0.219	1.050	4.79
Shampoo	0.811	1.615	1.99
Soft Drink	6.461	231.510	35.83
Soup	1.675	93.276	55.69
Tissues	0.435	1.438	3.31
Toilet tissue	0.027	0.113	4.19

Tomato Product ¹	0.895	1.305	1.46
Toothpaste	0.156	2.006	12.86
Tuna Fish	10.640	54.009	5.08
Vegetables	0.882	50.758	57.55
Water ¹	4.057	16.159	3.98
Yogurt	8.853	15.344	1.73

¹ The packaging weight per manufacturer serving comparison was used for these categories.

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5.2 Individual Product Group Data:

The analysis of each product category is based upon weight and volume of packaging materials. From these, weight per serving and volume of material per serving are calculated based on the number of servings or uses in the container. The volume basis refers to the volume of the solid packaging material that surrounds the product. The smallest value of packaging weight per standard use represents the least amount of packaging per amount of product for the product group being analyzed. The largest value for this comparison signifies the most packaging material per amount of product for the group.

Each product group is analyzed using six comparisons, three based on volume of packaging material, and three based on packaging material weight. The first volume comparison is the volume of packaging material per number of manufacturer servings. This comparison uses the labeled number of servings or uses for each product in the group. The second volume comparison is the volume of packaging per number of standard uses. The standard use values are based upon 100 calories per serving for foods. The standard use comparison for other product groups is based upon the amount of product consumed per use. The comment section for this type of product group contains the description of how the standard use was determined. The third volume comparison is the volume of packaging material per gram of product. This comparison is based on the volume of packaging material divided by the measured weight of the product. For liquids, this comparison is based on the volume of packaging material divided by the amount of liquid (ml). The first and second packaging weight comparisons are based on the manufacturer serving and standard use, respectively. The third packaging weight

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comparison is packaging weight per product weight comparison. This comparison uses the measured product weight in comparison to the packaging weight. For liquids, the measured volume of product (ml) is compared to the packaging weight.

The comparisons for each data group are listed in Tables 5.6 – 5.45. The discussion section for each product group includes a comment section describing the product group.

The bold highlight in each data table indicates the product that used the least packaging material per amount of product in the product group. The italicized data indicates the product that used the most packaging material per amount of product in the product group. Bar charts, figures 5.3 – 5.42 are also included to aid in the analysis of the product/packaging comparisons.

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BABY FOOD:

The baby food product category consisted of 4 product/package systems. The product group included dry and pre-mixed baby cereals. The standard use comparison for the dry baby food products were based upon calorie information in a non-prepared form. The standard use comparison for the prepared baby food is based upon calorie information for prepared baby food.

Table 5.6 Baby Food Comparative Data

Product Number	Volume Packaging/ manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
69	3.182	5.192	0.208	0.164	2.505	4.088
70	3.413	5.730	0.229	0.201	2.990	5.020
133	6.980	9.154	0.523	0.735	9.806	12.860
146	2.347	3.431	0.147	0.147	2.350	3.440

Product 146 used the least packaging material in this product group. This package consisted of a paper/plastic/foil laminate pouch. Product 133 used the most packaging material in the product group. This package consisted of a clear glass jar with a metal recloseable lid and a paper label.

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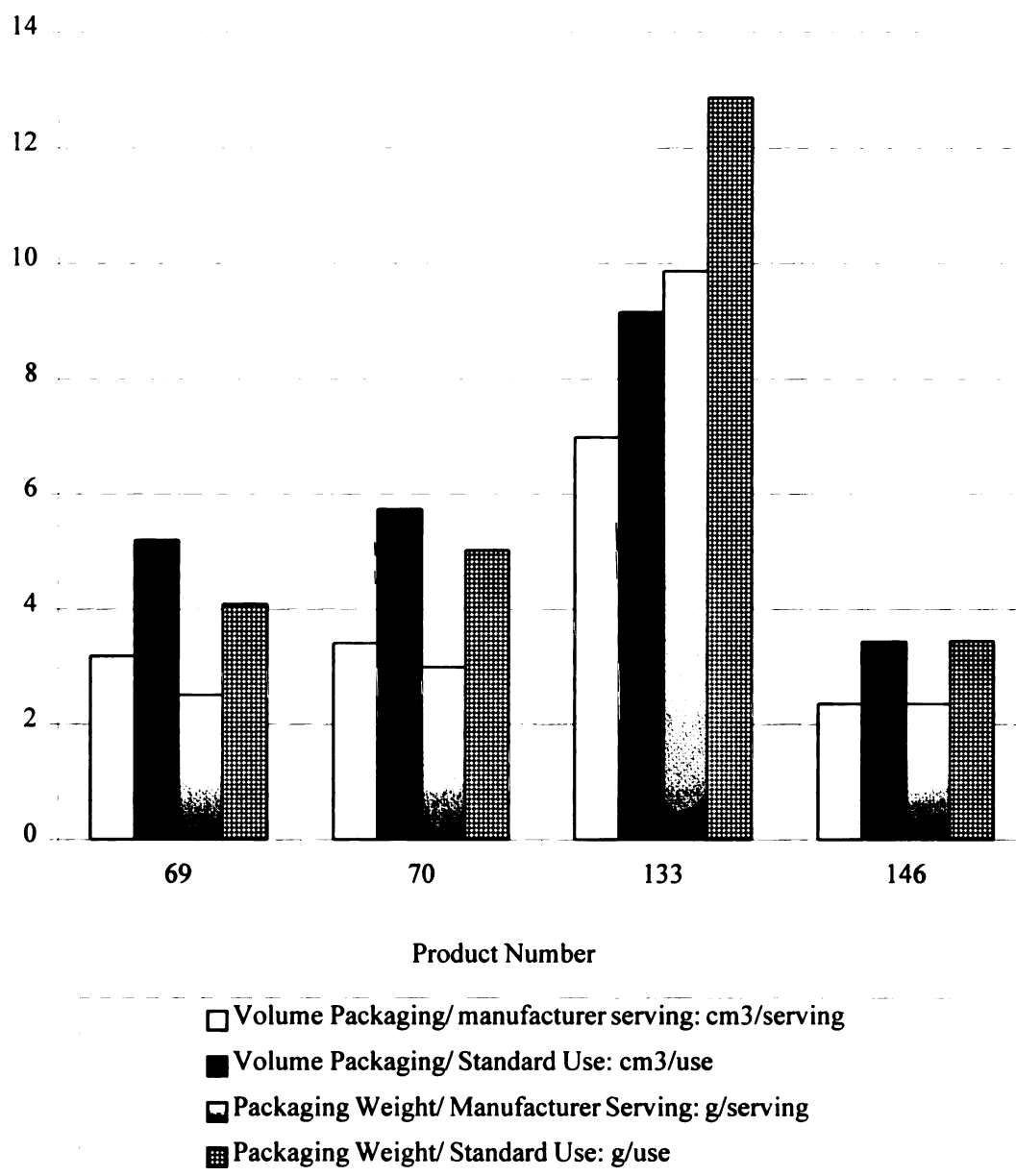


Figure 5.2 Baby Food Comparative Data

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BAKING MIX:

The baking mix product category consisted of 5 product/package systems. The type of mix chosen for analysis was muffin mix. The calorie information, used as the basis for the standard use comparison, was based upon calories of the baking mixes in a non-prepared form.

Table 5.7 Baking Mix Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
40	0.030	0.022	0.001	0.015	0.261	0.194
41	4.073	2.359	0.099	0.086	3.520	2.039
42	5.580	3.900	0.124	0.143	6.460	4.516
43	0.210	0.264	0.009	0.099	0.246	0.310
44	0.991	0.865	0.031	0.035	1.142	0.997

Product 40 used the least packaging material in the product group. The package for this product consisted of a plastic pillow pouch sealed on the top and bottom with a fin vertical seal. Product 42 used the most packaging material in the product group. This package consisted of a paperboard outer box, a plastic pillow pouch containing the muffin mix and a 2-piece steel can containing blueberry glaze.

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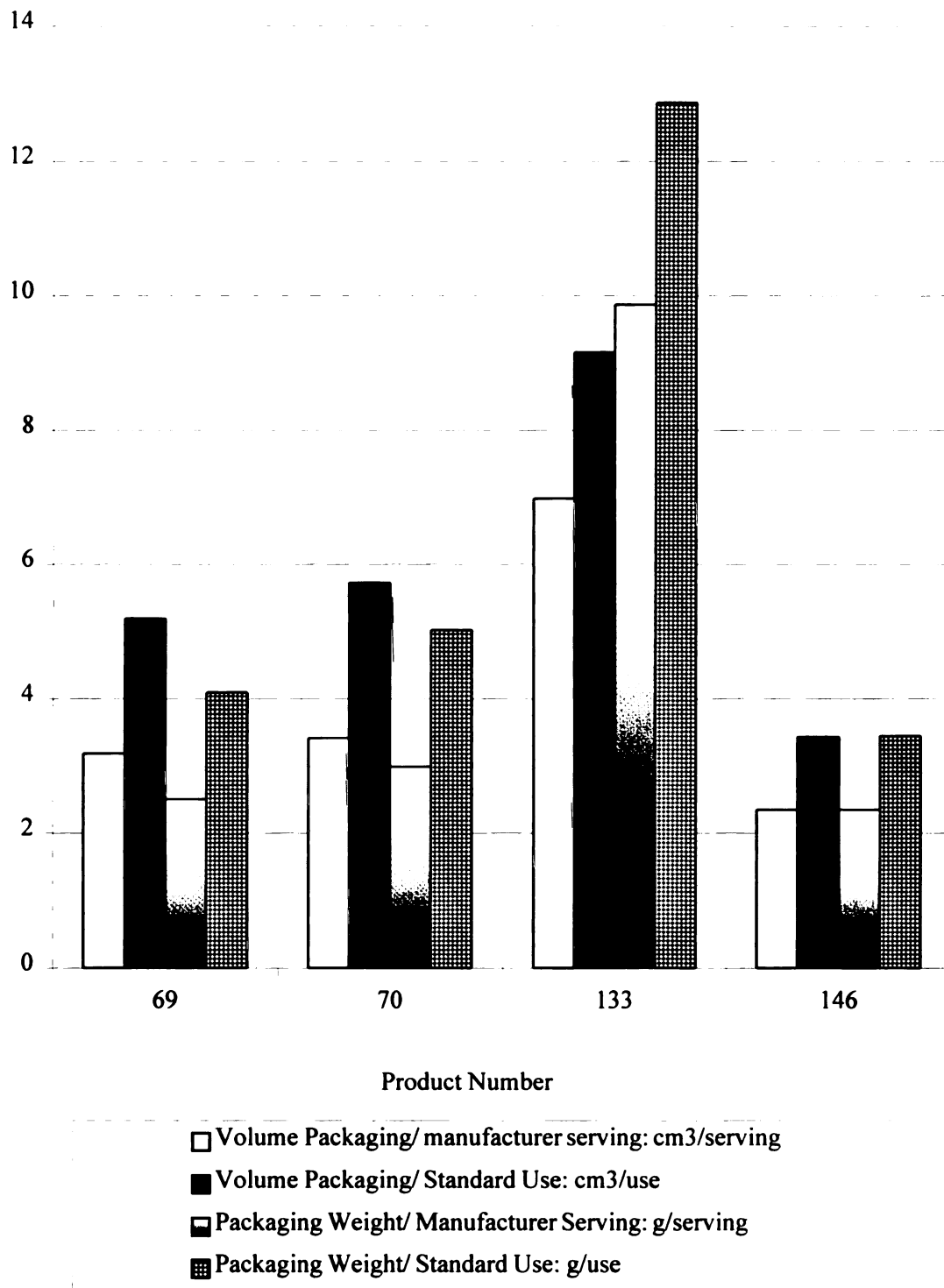


Figure 5.3 Baking Mix Comparative Data

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BEER:

The beer product category consisted of 6 product/package systems. Light beer was selected for each product in the study. The data for each is as follows:

Table 5.8 Beer Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
243	24.118	24.393	0.067	0.088	31.458	31.817
244	25.283	25.467	0.070	0.088	31.507	31.737
245	112.307	112.177	0.310	0.514	186.315	186.098
246	122.917	111.594	0.308	0.333	132.930	120.685
247	7.700	7.799	0.022	0.045	16.000	16.205
248	148.370	140.882	0.389	0.702	267.698	254.187

Product number 247 used the least packaging in the product group. This package consisted of 6 aluminum cans and a plastic ring holder. The most packaging is the group was found in product number 248. This package consisted of 6 amber glass bottles and a paperboard holder.

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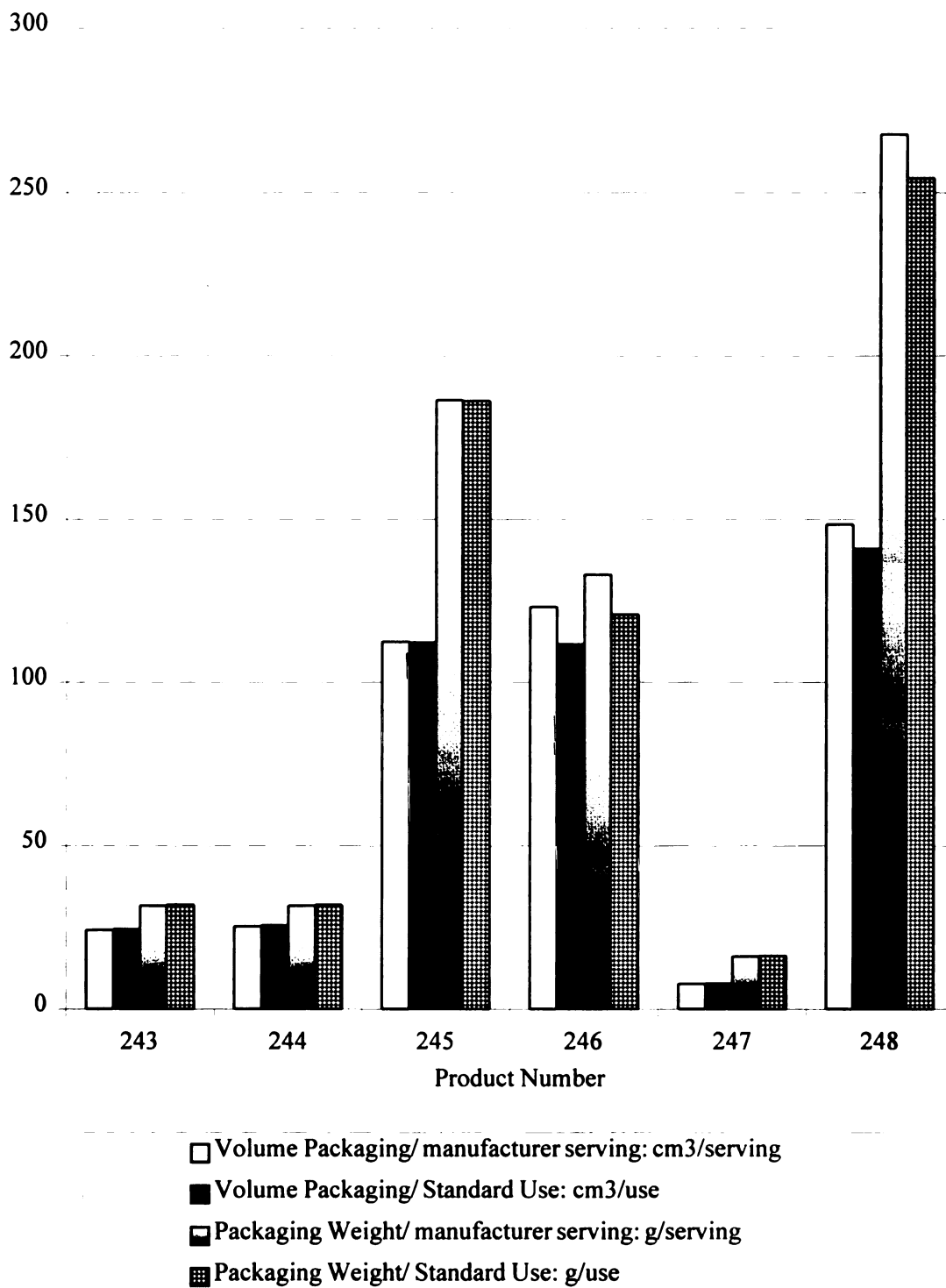


Figure 5.4 Beer Comparative Data

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BREAD:

The bread product category consisted of 3 product/package systems. The product type selected within the bread family was sliced white bread.

Table 5.9 Bread Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
77	0.535	0.632	0.018	0.017	0.499	0.589
78	0.511	0.456	0.011	0.015	0.676	0.603
79	0.509	0.562	0.016	0.018	0.573	0.633

The bread category resulted in similar values for each of the products analyzed. Product 77 used the least packaging material in this product group. This product was selected because the packaging weight per standard use comparison was the lowest for the product group. Product 79 used the most packaging material in this product group. The package for product 77 consisted of a single LDPE bag. Product 79 consisted of an outer LDPE bag and a white plastic inner wrap around the bread.

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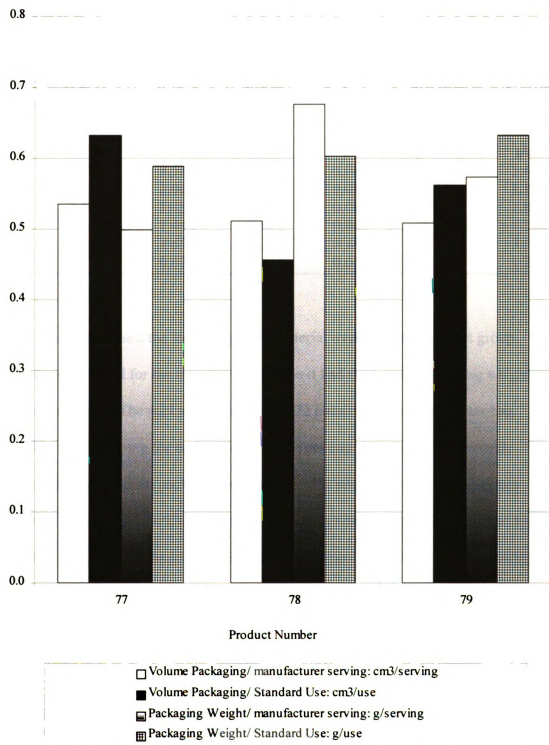


Figure 5.5 Bread Comparative Data

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CANDY:

The candy product group consisted of 6 product/package systems. The candy selected for analysis in this study was chocolate peanut butter cups.

Table 5.10 Candy Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
71	6.773	3.582	0.200	0.083	2.795	1.478
72	2.165	1.061	0.057	0.064	2.430	1.191
73	7.455	1.757	0.093	0.098	7.830	1.845
74	3.655	1.459	0.081	0.069	3.120	1.246
75	9.079	4.698	0.263	0.189	6.524	3.376
76	1.372	0.675	0.036	0.068	2.567	1.263

Product 72 used the least packaging material overall in this product group. This product was selected for the market basket since it had the lowest packaging weight per standard use value. The packaging for Product 72 consisted of a plastic outer bag, individual foil wrapping for each candy and a paper cup that contains each candy. Product 75 used the most packaging material for this product group. The package consisted of a plastic (LDPE) outer bag, an inner paperboard tray holding the candies, individual paper/plastic laminate outer candy wrappings, paperboard candy backing cards, and individual paper cups holding each candy.

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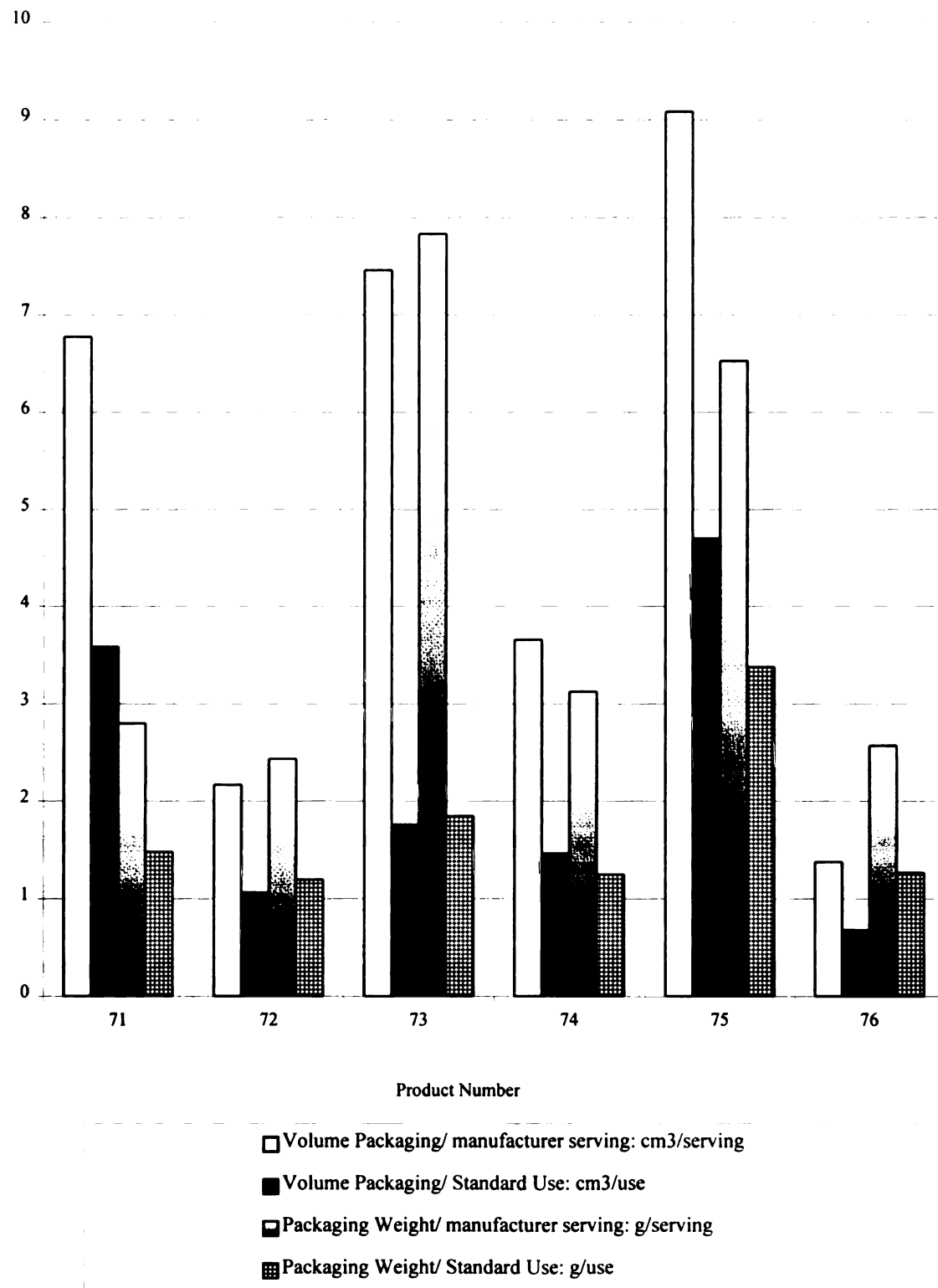


Figure 5.6 Candy Comparative Data

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CEREAL:

The cereal category was composed of 9 different product/packaging types. This category included oatmeal and dry cereal. The dry cereals selected for analysis were Cheerios and Tastee-os.

Table 5.11 Cereal Comparative Data

Product Number	Volume of packaging/ Manufacturer serving cm3/serving	Volume of packaging/ Standard Use cm3/use	Volume packaging/ Product weight cm3/g	Packaging weight/ Product weight g/g	Packaging weight/ Manufacturer servings g/serving	Packaging weight/ Standard use g/use
1	15.906	10.617	0.3981	0.119	4.763	3.173
2	4.517	2.966	0.1112	0.0891	3.618	2.376
3	6.374	5.695	0.2034	0.1183	3.707	3.312
25	4.539	3.178	0.1141	0.0972	3.866	2.707
26	5.874	4.11	0.1475	0.1321	5.258	3.679
4	11.648	10.056	1.0263	0.8219	9.388	8.105
5	9.827	8.967	0.3288	0.2624	7.842	7.155
6	2.639	2.265	0.0831	0.0229	0.727	0.624
7	20.114	16.409	0.6289	0.5484	17.474	14.255

Product 6 was found to produce the least packaging in this category. This package consisted of a single low-density polyethylene (LDPE) bag. Product 7 was found to produce the most packaging in this category. This packaging system was composed of 8 individual paperboard boxes, 8 plastic internal bags, and an LDPE outer plastic wrapping.

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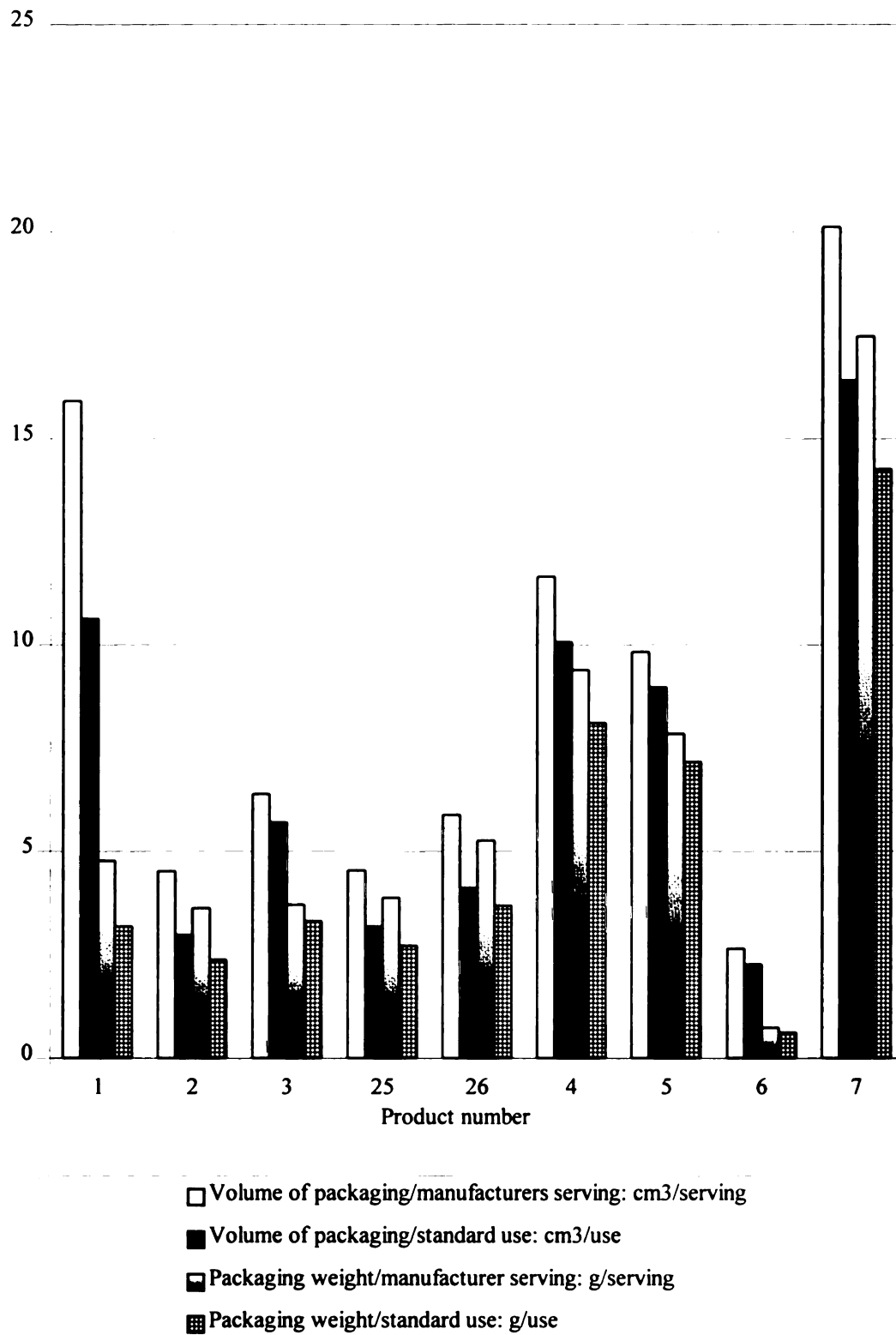


Figure 5.7 Cereal Comparative Data

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CHEESE:

The cheese product group consisted of 10 product/package systems. The products in this group included block cheese, sliced cheese and cheese spread.

Table 5.12 Cheese Comparative Data

Product Number	Volume Packaging/ Manufacturer serving	Volume Packaging/ Standard Use	Volume Packaging/ Product Weight	Packaging Weight/ Product Weight	Packaging Weight/ Manufacturer serving	Packaging Weight/ Standard Use
	cm3/serving	cm3/use	cm3/g	g/g	g/serving	g/use
147	0.215	0.191	0.007	0.011	0.322	0.286
148	2.526	2.211	0.087	0.071	2.063	1.806
149	1.388	2.303	0.073	0.059	1.129	1.873
150	0.715	0.997	0.033	0.029	0.619	0.863
151	1.023	0.842	0.034	0.035	1.076	0.886
152	2.004	2.957	0.074	0.071	1.933	2.852
153	0.797	0.696	0.027	0.024	0.705	0.616
154	1.773	1.878	0.060	0.059	1.719	1.820
<i>155</i>	<i>29.542</i>	<i>30.842</i>	<i>0.991</i>	<i>1.848</i>	<i>55.080</i>	<i>57.503</i>
156	1.893	3.031	0.065	0.059	1.728	2.767

Product number 147 used the least packaging in this product group. This package consisted of a plastic vacuum-sealed pouch. Product 155 used the most packaging in this product group. This package consisted of a ceramic recloseable jar with a rubber gasket, inside of which a sealed plastic bag contained the cheese product. The bag was sealed with two metal clamps.

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Figure

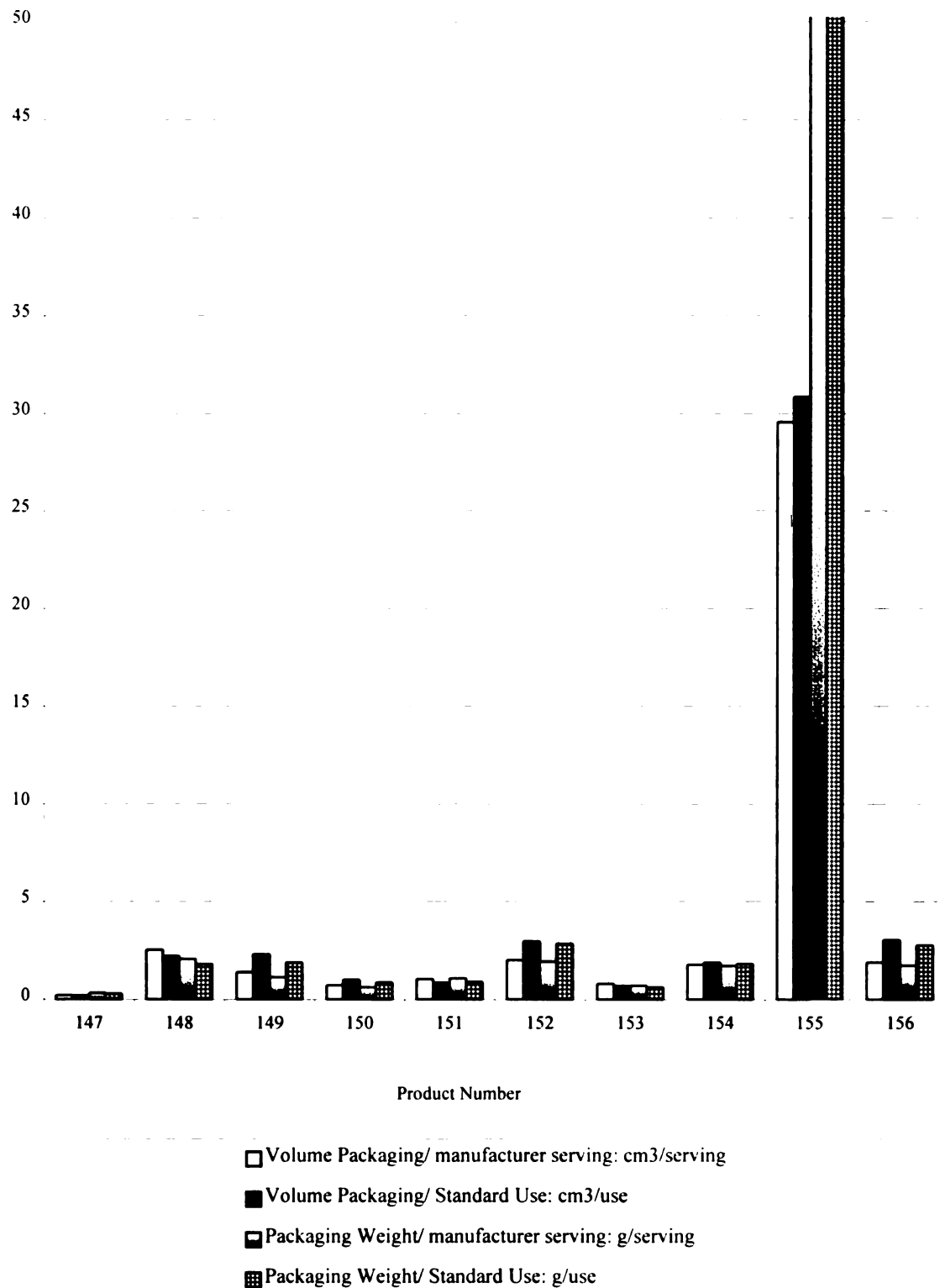


Figure 5.8 Cheese Comparative Data

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CHIPS:

This product group consisted of 5 product/package systems. The type of chip selected for the product group was plain potato chips.

Table 5.13 Chip Comparative Data

Product Number	Volume of packaging/ Manufacturer serving cm3/serving	Volume of packaging/ Standard Uses cm3/use	Volume packaging/ Product Weight cm3/g	Packaging weight/ Product weight g/g	Packaging weight/ Manufacturer servings g/serving	Packaging weight/ Standard uses g/use
35	1.705	1.108	0.0594	0.0522	1.500	0.976
36	2.591	1.605	0.0851	0.0726	2.210	1.369
37	1.113	0.686	0.0392	0.0339	0.962	0.593
38	<i>10.640</i>	<i>6.552</i>	<i>0.3744</i>	<i>0.2720</i>	<i>7.732</i>	<i>4.761</i>
39	5.294	3.319	0.1897	0.1701	4.746	2.976

Product 37 was found to use the least packaging in this product group. This package consisted of a plastic/paper-laminated bag, sealed on the top and bottom, with a fin vertical seal. Product 38 used the most packaging in the product group. This package consisted of a paperboard tube with an aluminum bottom, a paper/foil/plastic laminate sealed top and a plastic (HDPE) recloseable lid.

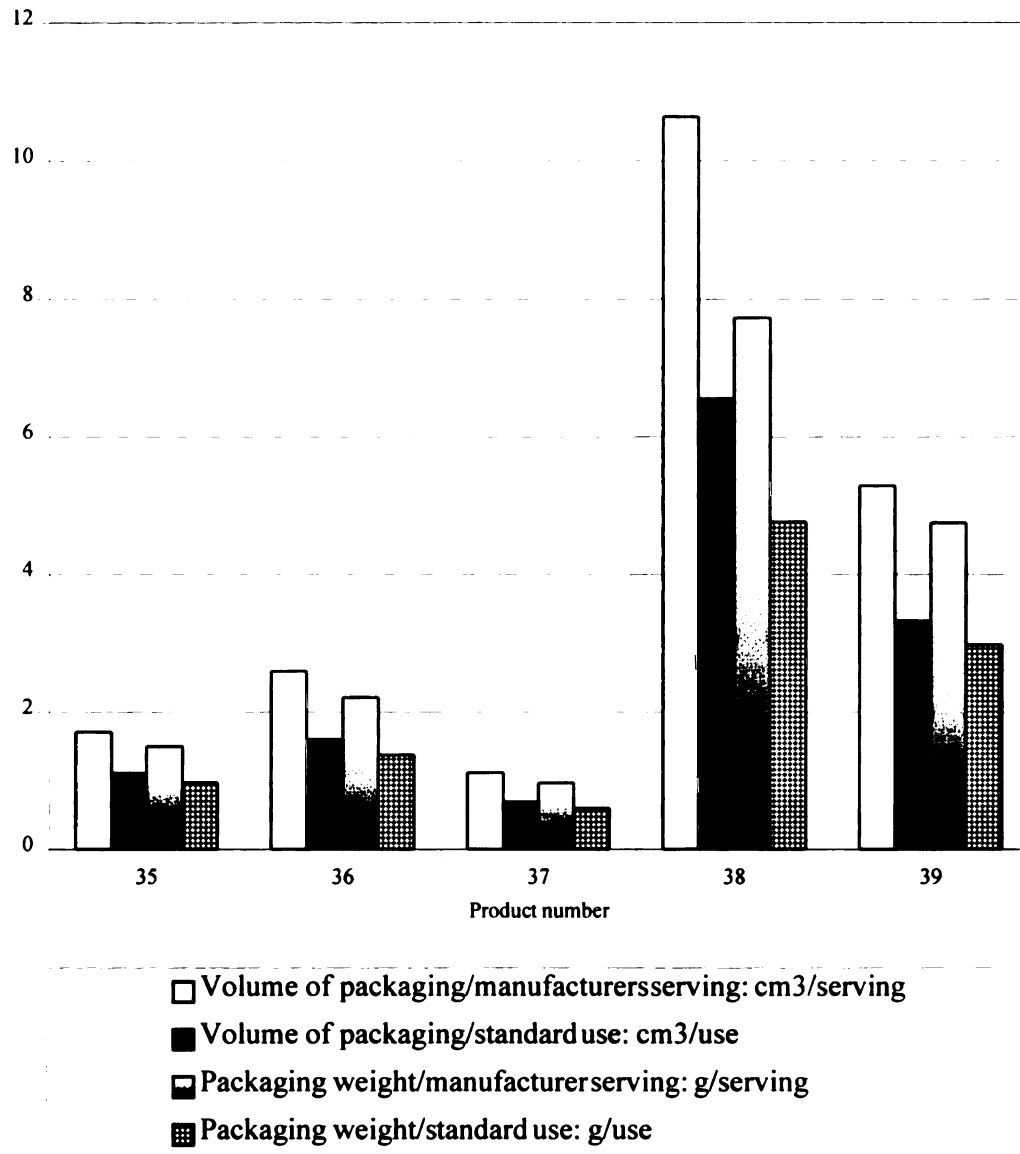


Figure 5.9 Chip Comparative Data

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CLEANERS:

The cleaner group was composed of 4 product/package systems. This group was made entirely of floor cleaners. The standard use comparison was made using ¼ cup (59 ml for liquid product or 30 g for dry product) as the use amount.

Table 5.14 Cleaners Comparative Data

Product Number	Volume Packaging/ Manufacturer uses cm3/uses	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer uses g/uses	Packaging Weight/ Standard Use g/use
173	3.681	3.633	0.061	0.062	3.716	3.668
175	4.828	4.624	0.078	0.070	4.309	4.127
249	3.475	3.288	0.056	0.063	3.948	3.736
			cm3/g	g/g		
250	3.633	3.380	0.113	0.091	2.932	2.728

Product 250 used the least packaging material in the product group based on weight per manufacturer's use and standard use values. This package consisted of a laminated paperboard box. Product 175 used the most packaging in this product group. This package consisted of a high-density polyethylene (HDPE) bottle.

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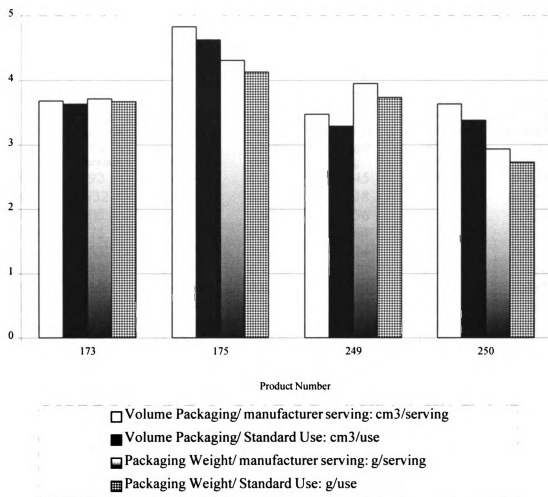


Figure 5.10 Cleaners Comparative Data

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COOKIES:

The cookie product category consisted of 11 product/package systems. This product group consisted mainly of chocolate chip cookies. Fudge sandwich cookies and chocolate/fudge shortbread cookies were included because different packaging systems were found for these items.

Table 5.15 Cookie Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
17	3.892	2.425	0.121	0.045	1.443	0.899
18	10.932	8.283	0.414	0.118	3.103	2.351
19	1.905	1.402	0.070	0.056	1.509	1.110
20	6.675	5.407	0.234	0.164	4.684	3.795
21	5.953	4.857	0.251	0.024	0.567	0.462
22	3.730	2.943	0.141	0.053	1.408	1.111
23	0.716	0.427	0.018	0.017	0.675	0.402
24	7.133	3.400	0.170	0.087	3.650	1.742
27	<i>12.545</i>	<i>19.803</i>	<i>0.680</i>	<i>0.273</i>	<i>5.192</i>	<i>8.196</i>
28	4.887	2.730	0.137	0.127	4.553	2.543
29	6.468	2.754	0.143	0.042	1.884	0.802

Product 23 used the least packaging material in this product group based on packaging weight per standard use. The package for this product consisted of a plastic/foil laminate pillow pouch. The pouch was sealed on the top and bottom with a vertical fin seal. Product 27 used the most packaging material for the product group. This package was composed of a gable-top paperboard carton, a plastic/foil laminate pouch and a polystyrene (PS) tray. The plastic/foil pouch contained the polystyrene tray, which held the cookies.

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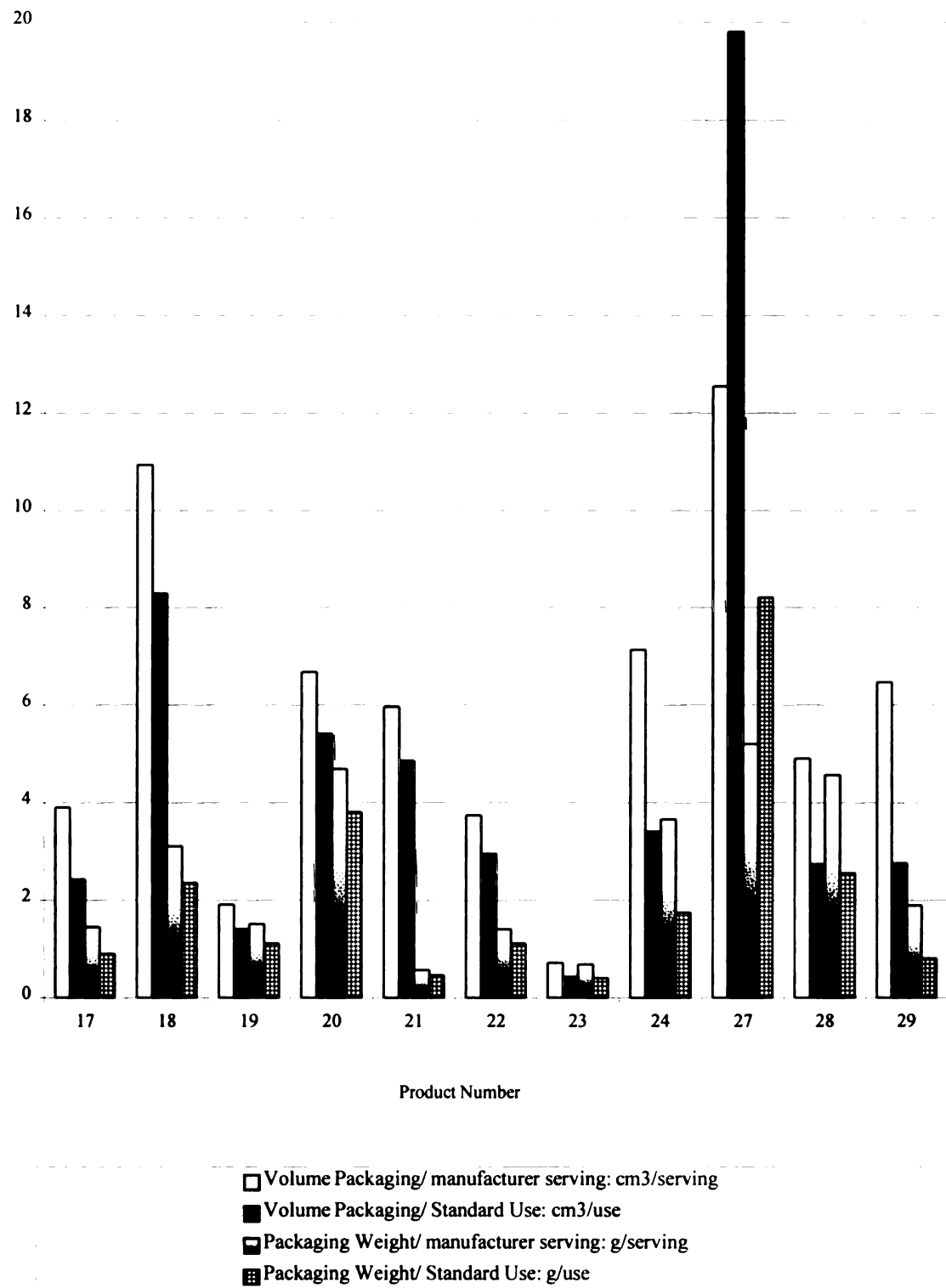


Figure 5.11 Cookie Comparative Data

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CRACKERS:

The cracker product group consisted of 5 different product/package systems. The product group was composed of saltines, butter-type crackers (Ritz), and oyster crackers.

Table 5.16 Cracker Comparative Data

Product Number	Volume packaging/ Manufacturer serving cm3/serving	Volume packaging/ Standard use cm3/use	Volume packaging/ Product Weight cm3/g	Packaging weight/ Product Weight g/g	Packaging weight/ Manufacturer servings g/serving	Packaging weight/ Standard use g/use
30	2.936	3.445	0.1723	0.1597	2.722	3.194
31	2.821	4.421	0.1768	0.1506	2.402	3.764
32	3.392	3.996	0.1998	0.1578	2.679	3.156
33	0.776	1.25	0.0500	0.0479	0.743	1.198
34	0.207	0.344	0.0138	0.0150	0.225	0.374

Product 34 used the least packaging in the product group. This packaging system consisted of a single plastic LDPE bag. This bag was sealed on the top, bottom and a fin vertical back seal. Products 31 used the most packaging material in the product group based on the packaging weight per standard use comparison. The package for this product consisted of a paperboard box and 3 plastic cracker bags. Each internal bag was sealed on 3 sides, the top, bottom and a vertical fin seal.

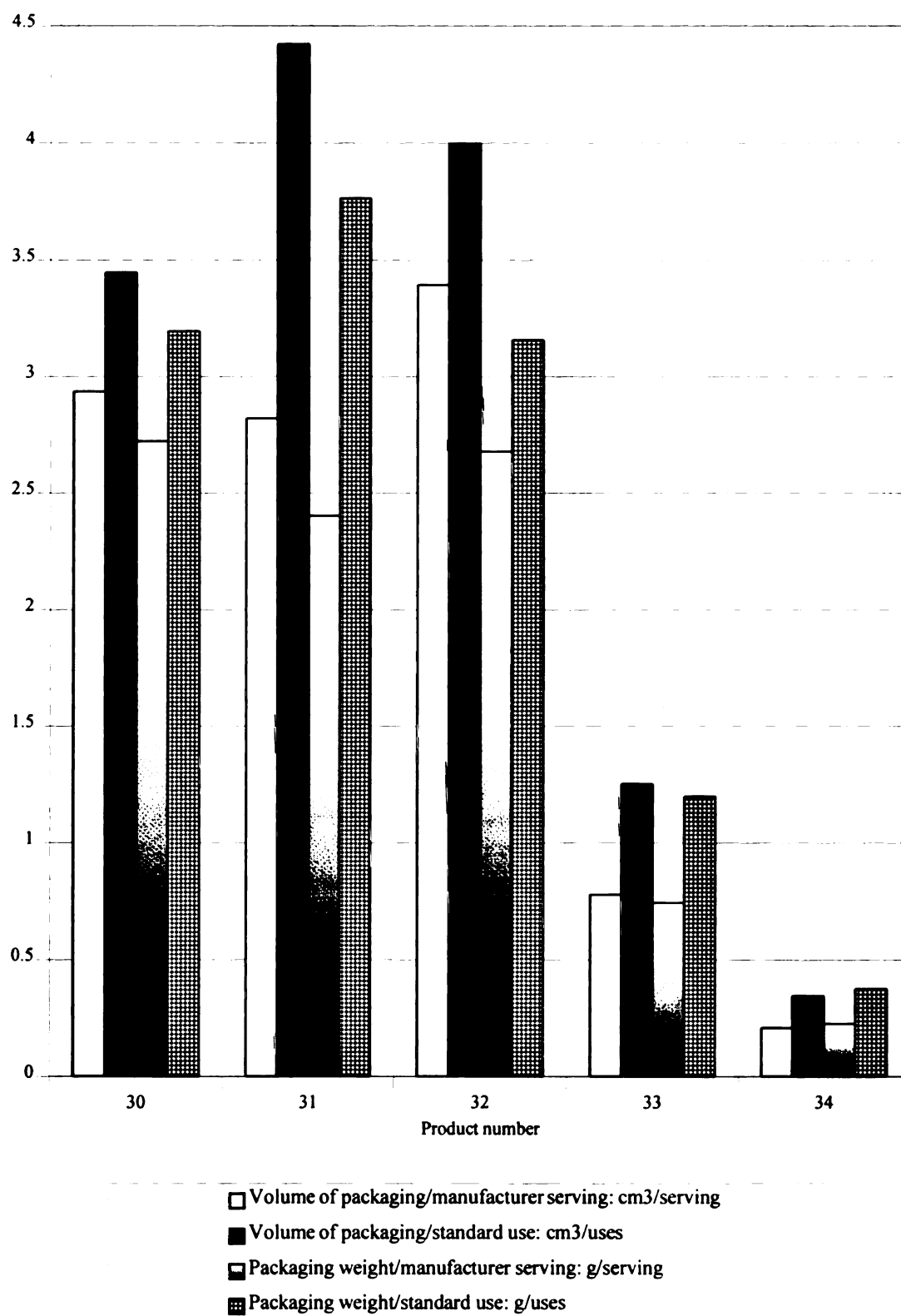


Figure 5.12 Cracker Comparative Data

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DINNERS:

This product category consisted of 9 different product/package types. This product category included refrigerated, shelf-stable and frozen dinners. The EPS (expanded polystyrene) foam trays found in some packaging systems in this group were measured without being compacted.

Table 5.17 Dinner Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
185	110.210	32.025	0.437	0.103	25.913	7.530
186	8.717	2.663	0.041	0.039	8.456	2.583
187	10.033	3.054	0.100	0.080	8.060	2.453
188	9.254	3.476	0.129	0.113	8.127	3.053
189	7.099	2.673	0.099	0.091	6.508	2.451
190	9.991	2.978	0.097	0.084	8.628	2.517
<i>191</i>	<i>69.417</i>	<i>20.844</i>	<i>0.194</i>	<i>0.184</i>	<i>65.970</i>	<i>19.809</i>
192	54.379	19.321	0.184	0.159	46.860	16.650
193	7.986	4.626	0.037	0.129	28.050	16.250

Product 189 used the least packaging material in this product group based on packaging weight per standard use data. This packaging system consisted of a paperboard carton and a plastic/foil/paper laminate pouch. This product was a shelf-stable dinner. Product 191 used the most packaging material in this product group. Product 191 was selected for the market basket comparison because of this system having the largest packaging weight per standard use comparison value. Product 191 consisted of a paperboard outer box; a PET plastic plate and a plastic film cover over the plate.

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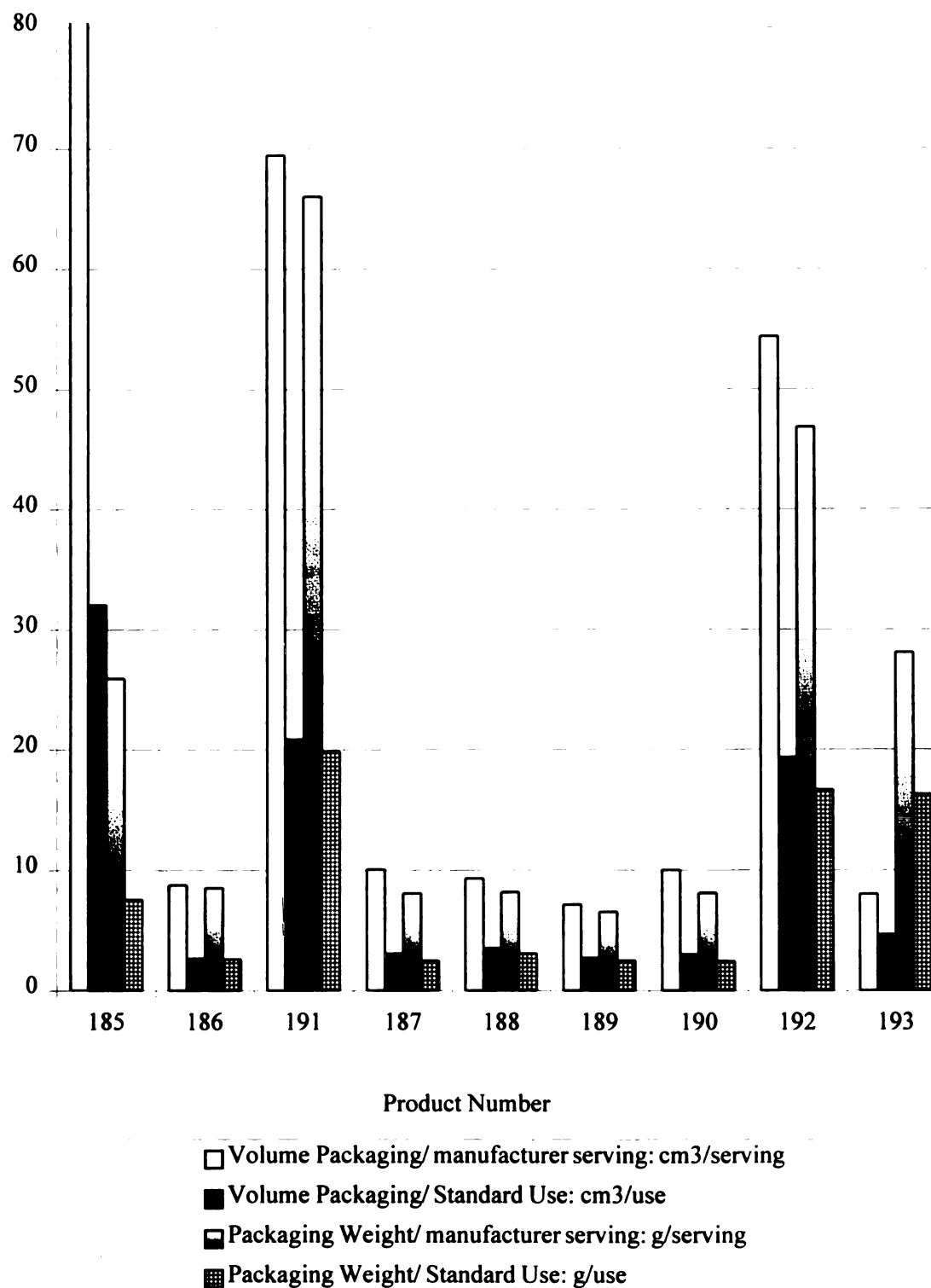


Figure 5.13 Dinner Comparative Data

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DISH SOAP:

This category consisted of 2 different product types, hand dish soap, and automatic dish soap. The category was split into these two sub-categories for comparison purposes, since hand soaps cannot be used in automatic dishwashers. The comparative data does not include manufacturer's use size comparisons because such information was not provided on the package. The standard use comparisons were based upon a one wash basis, which was determined to be 15 ml for hand soaps and 56 g for automatic dish soaps. These were based upon normal use levels determined in the ad hoc study done for this report.

Table 5.18 Dish Soap Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
Hand						
176	*	0.208	0.034	0.057	*	0.355
177	*	0.257	0.042	0.069	*	0.430
178	*	0.219	0.035	0.047	*	0.290
179	*	0.262	0.042	0.056	*	0.344
Automatic			cm3/g	g/g		
180	*	3.423	0.061	0.057	*	3.204
181	*	2.792	0.050	0.052	*	2.889

Hand Dish Soap:

Product 178 used the least packaging material in this product group. Product 178 consisted of a 42 fl.oz. HDPE bottle and a recloseable cap. Product 177 used the most packaging material in this product group. This product consisted of a 14.7 fl.oz. PET bottle with a recloseable cap.

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Automatic Dish Soap:

Product 181 used the least packaging material in this product group. This package consisted of an HDPE plastic bottle with a flip-top closure. Product 180 used the most packaging in this product group. This package consisted of a paperboard box with a plastic/foil laminate outer label covering the entire box.

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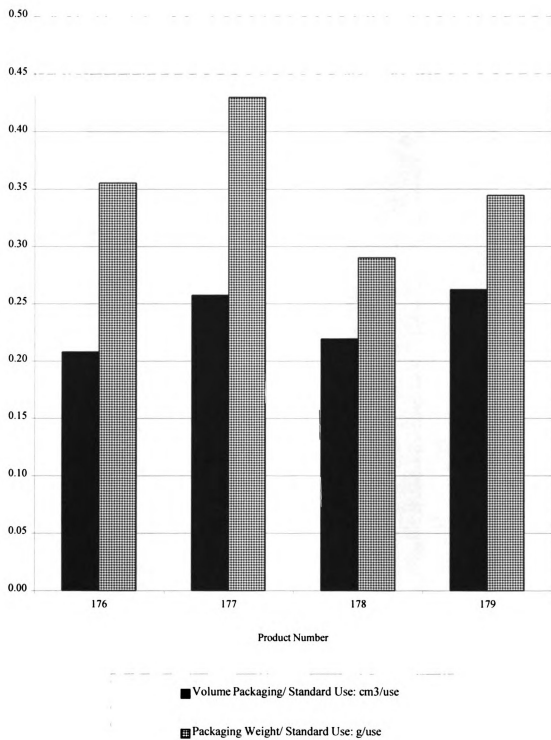


Figure 5.14 Hand Dish Soap Comparative Data

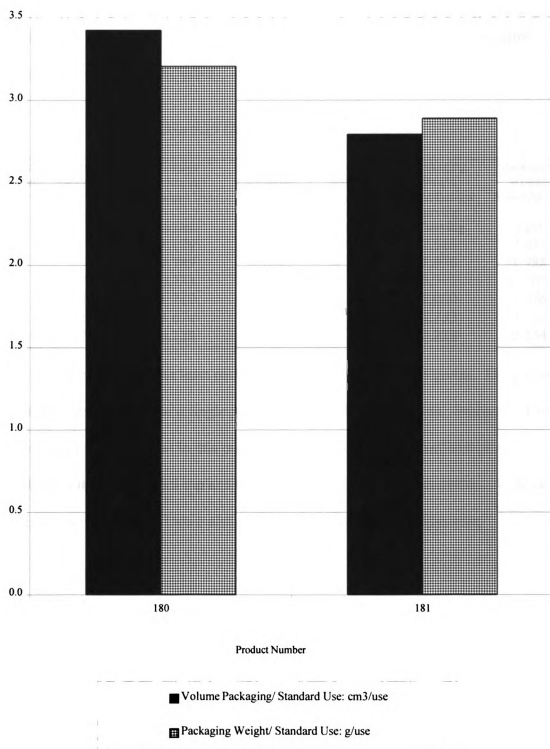


Figure 5.15 Automatic Dish Soap Product Category

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DRINK MIX:

The drink mix product category consisted of 5 product/package systems. The standard use comparison was based upon 240 ml of prepared drink for each product in the category. This method was used instead of calories since a majority of the drink mixes had little or no caloric value.

Table 5.19 Drink Mix Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
117	1.073	1.129	0.019	0.043	2.511	2.641
118	1.778	1.789	0.104	0.115	1.976	1.988
119	0.742	0.733	0.556	0.533	0.711	0.702
120	1.134	1.219	1.002	0.884	1.000	1.076
121	1.651	1.674	0.097	0.186	3.153	3.198
259	0.209	0.220	0.361	0.385	0.223	0.234

Product 259 used the least packaging material in the product group. The package for this product consisted of a single paper/plastic/foil laminate pouch. Product 121 used the most packaging material in this product group. This package consisted of a paperboard tube with a metal top and bottom, the top of which is removable. A plastic HDPE lid and a paper label were also components of this packaging system.

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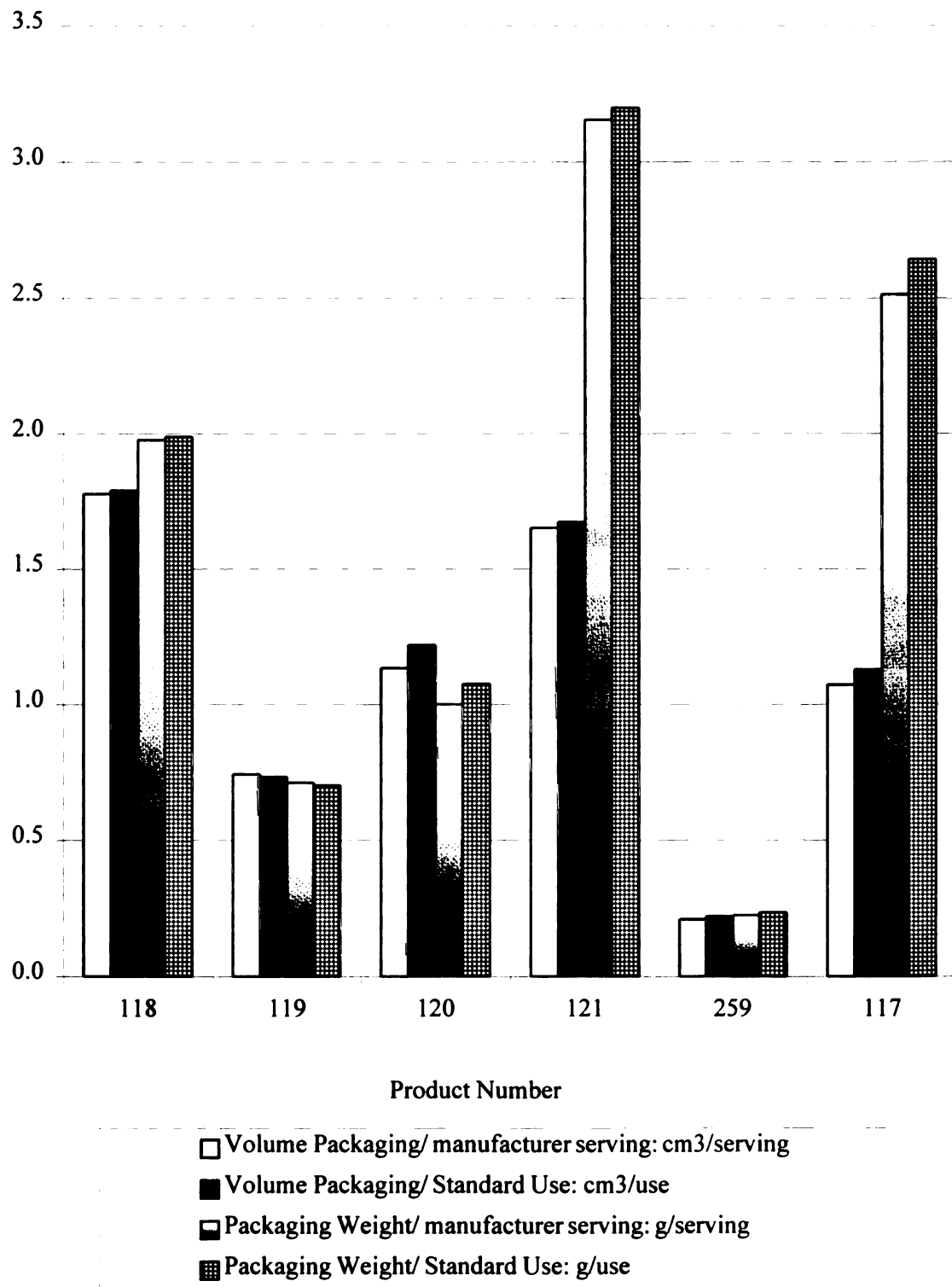


Figure 5.16 Drink Mix Comparative Data

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EGGS:

The egg product category consisted of 4 product/package systems. The expanded polystyrene (EPS) cartons found in this category were analyzed in a non-compacted form.

Table 5.20 Egg Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm ³ /serving	Volume Packaging/ Standard Use cm ³ /use	Volume Packaging/ Product Weight cm ³ /g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
171	18.118	22.871	0.320	0.023	1.304	1.646
172	9.986	12.423	0.174	0.070	4.042	5.028
174	7.927	10.898	0.153	0.059	3.060	4.206
258	12.921	17.901	0.251	0.027	1.384	1.918

Product 171 used the least packaging material on a packaging weight per standard use basis. The package for 171 consisted of an expanded polystyrene (EPS) foam container with 12 eggs. Product 172 used the most material on a packaging weight per standard use basis. Product 172 consisted of a pulpboard carton for 12 eggs.

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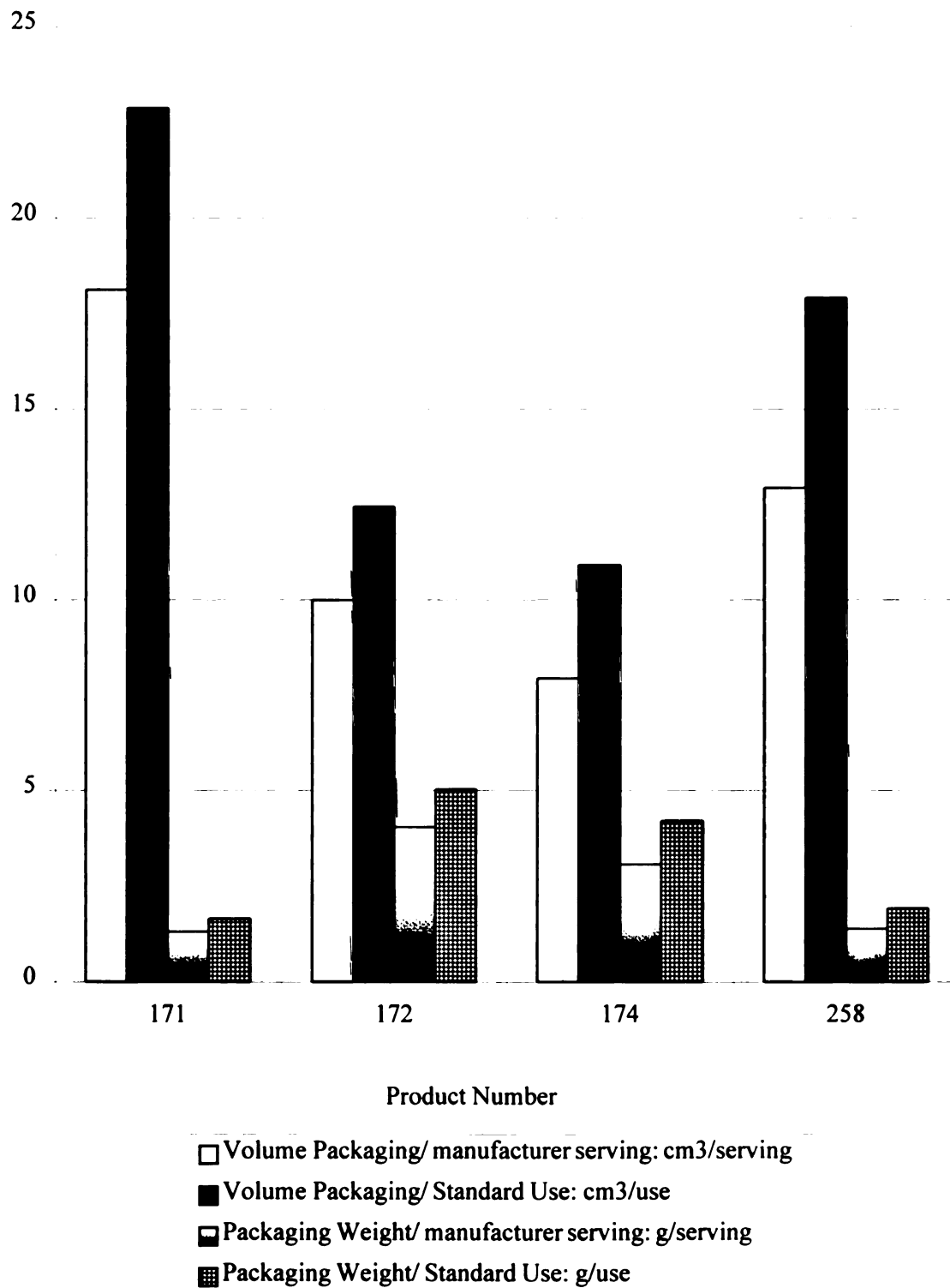


Figure 5.17 Egg Comparative Data

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FRUIT:

This product category consisted of 6 product/packaging systems. Included in this group were canned, bottled and fresh fruit. The manufacturer serving size and calorie information for fresh fruits was taken from the Food and Drug Administration fruit and produce information available in the grocery stores. The product group consisted of peaches, oranges and papaya.

Table 5.21 Fruit Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
214	.530	.702	0.003	0.004	0.662	0.877
<i>215</i>	<i>18.223</i>	<i>26.277</i>	<i>0.146</i>	<i>0.457</i>	<i>56.997</i>	<i>82.185</i>
216	4.664	7.685	0.037	0.132	16.537	27.248
217	5.387	4.898	0.039	0.133	18.560	16.877
218	19.878	24.049	0.170	0.257	30.000	36.296
221	1.045	1.519	0.007	0.005	0.830	1.207

Product 214 used the least packaging material in this product group. This package consisted of a plastic mesh bag and an adhesive paper/plastic laminate label.

Product 215 used the most packaging material for the fruit product group. This package consisted of a clear glass jar with a metal lug cap, and an adhesive plastic label.

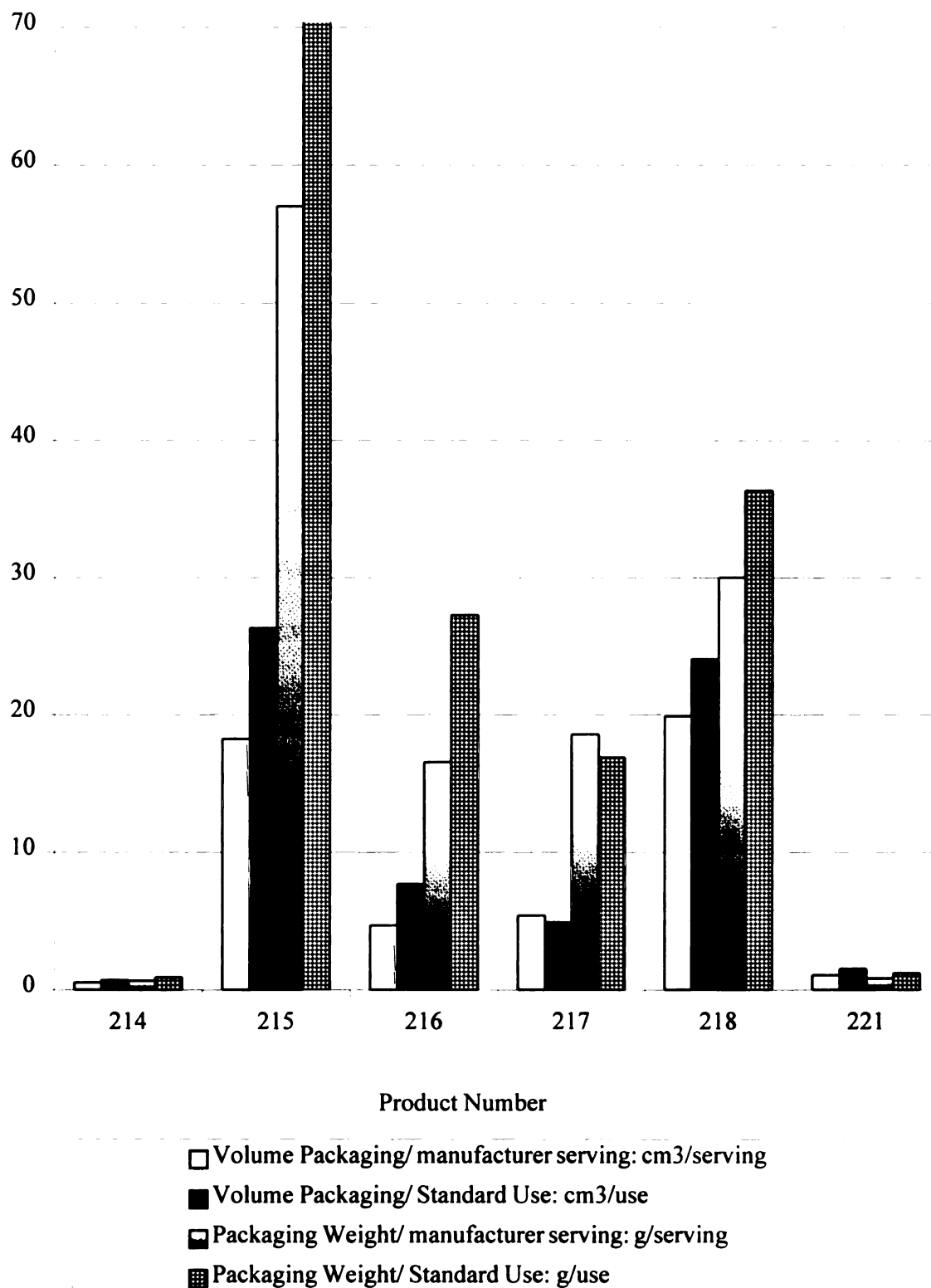


Figure 5.18 Fruit Comparative Data

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GUM:

The chewing gum product category consisted of 5 product/package systems. The standard use comparisons were not reported for this category due to gum not being used for nutritional value.

Table 5.22 Gum Comparative Data

Product Number	Volume packaging/ Manufacturer serving cm3/serving	Volume packaging/ Standard use cm3/use	Volume packaging/ Product weight cm3/g	Packaging weight/ Product weight g/g	Packaging weight/ Manufacturer servings g/serving	Packaging weight/ Standard use g/use
45	0.359	*	0.0789	0.0975	0.444	*
46	0.481	*	0.0921	0.0921	0.520	*
47	0.571	*	0.2096	0.2096	0.591	*
48	0.547	*	0.1698	0.1698	0.548	*
<i>134</i>	<i>1.07</i>	*	<i>0.3852</i>	<i>0.3852</i>	<i>0.957</i>	*

Product number 45 used the least packaging. This package consisted of 4 individual plastic/foil laminate packs, 20 waxed paper gum wrappers and a plastic over-wrap. The most packaging was product 134. This packaging type was composed of a paperboard sleeve, a plastic blister package with 12 blisters, and a foil backing over the blisters.

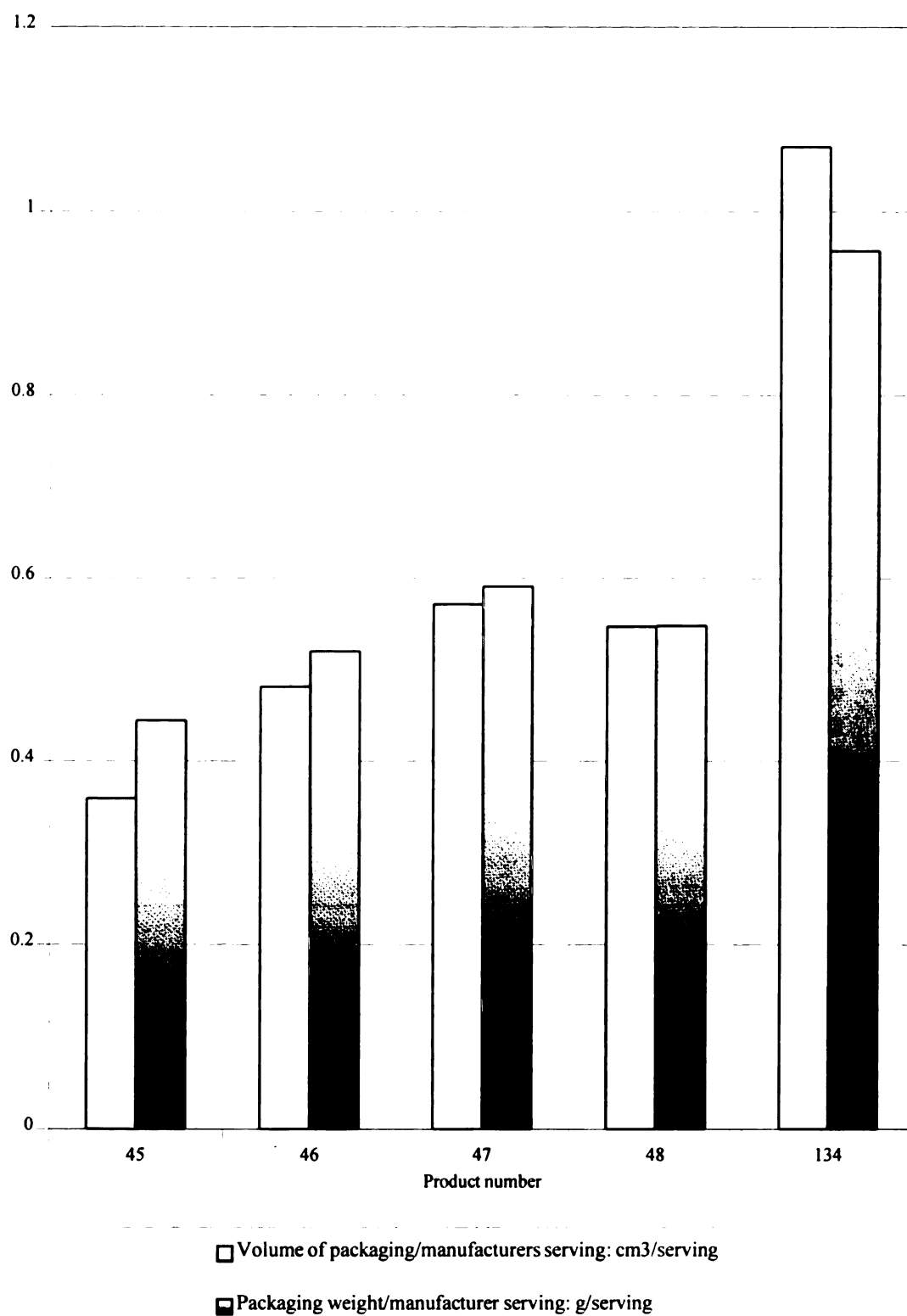


Figure 5.19 Gum Comparative Data

HAND SOAP:

This product group consisted of 9 product/package systems including bar soaps and liquid soaps. Manufacturer use amounts were not used as comparisons in this group because the manufacturers did not provide such information. The standard use amount was based upon actual hand washing analysis. The analysis consisted of a series of hand washings, from which the average soap per use was calculated for each product type (liquid or bar). This analysis determined that bar soap was used at 2.1 g/washing, and liquid soap was used at 5 ml/washing.

Table 5.23 Hand Soap Comparative Data

Product Number	Volume Packaging/Standard Use cm3/use	Volume Packaging/Product Weight cm3/g	Packaging Weight/Product Weight g/g	Packaging Weight/Standard Use g/use
8	0.499	0.100	0.172	0.859
9	0.217	0.103	0.077	0.162
10	0.041	0.019	0.021	0.043
11	0.052	0.025	0.023	0.049
12	0.185	0.088	0.066	0.138
13	1.046	0.209	0.234	1.170
14	0.243	0.116	0.081	0.171
15	0.064	0.031	0.028	0.059
16	0.574	0.115	0.174	0.872

Product 10 used the least packaging material in this product group. This package consisted of 3 paper/plastic laminate soap wraps and plastic over-wrap. The most packaging material was used by product 13, which consisted of a paperboard outer carton, a plastic (PET) bottle and a plastic pump.

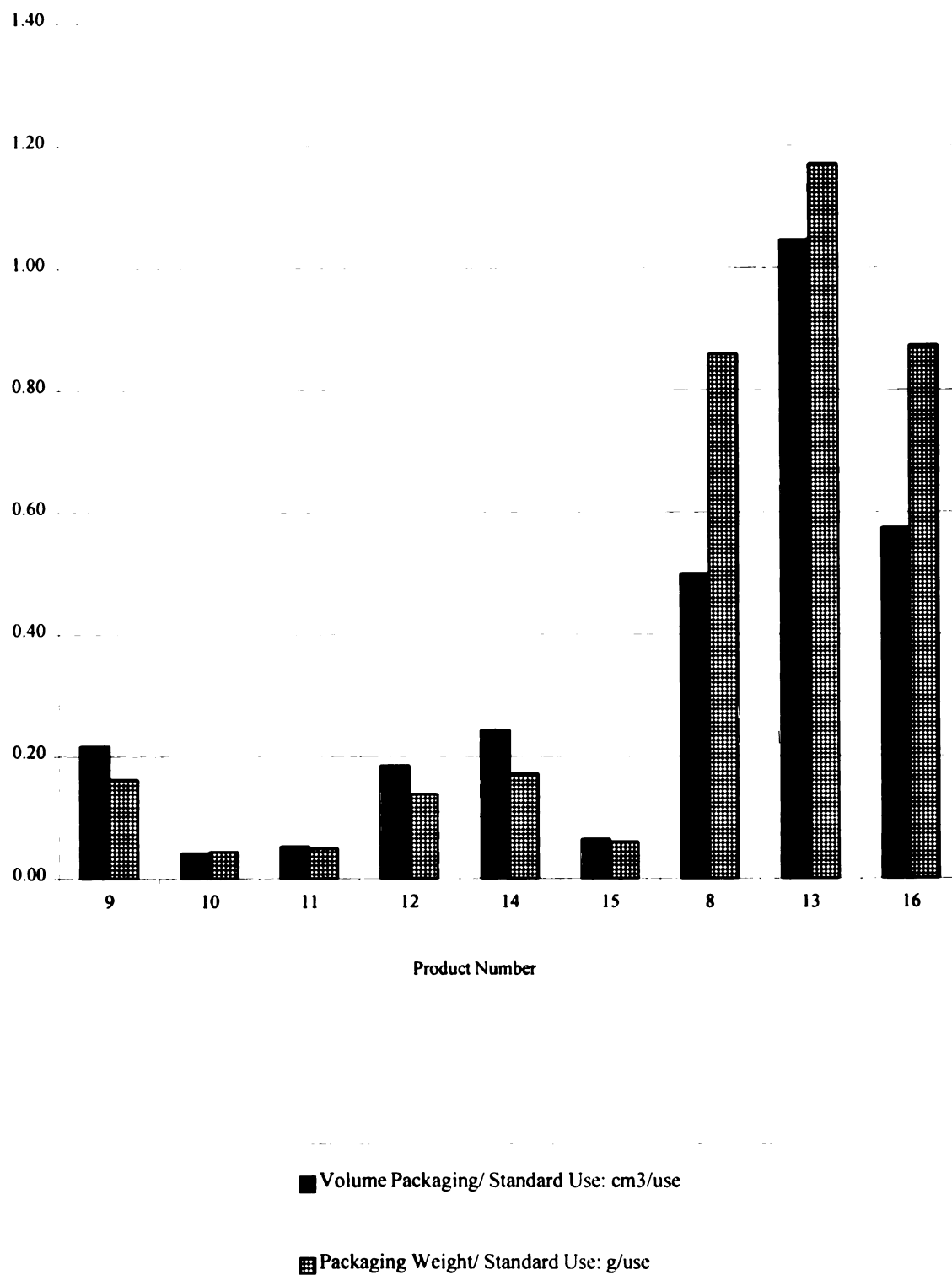


Figure 5.20 Hand Soap Comparative Data

ICE CREAM:

This product category consisted of 5 product/package systems. The products selected for this category were all regular ice cream. Other ice cream products, such as fat free, use similar package systems.

Table 5.24 Ice Cream Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
236	2.240	1.853	0.035	0.031	1.967	1.628
237	4.695	2.917	0.064	0.050	3.665	2.277
238	4.662	3.050	0.066	0.053	3.748	2.452
239	4.421	2.433	0.051	0.044	3.813	2.099
240	4.248	1.562	0.040	0.034	3.641	1.339

Product 240 used the least packaging in this product group on a packaging weight per standard use basis. This package consisted of a paperboard tub and a paperboard lid. Product 238 used the most packaging in the analysis of this product group. Product 238 consisted of a laminated paperboard carton and a plastic lid.

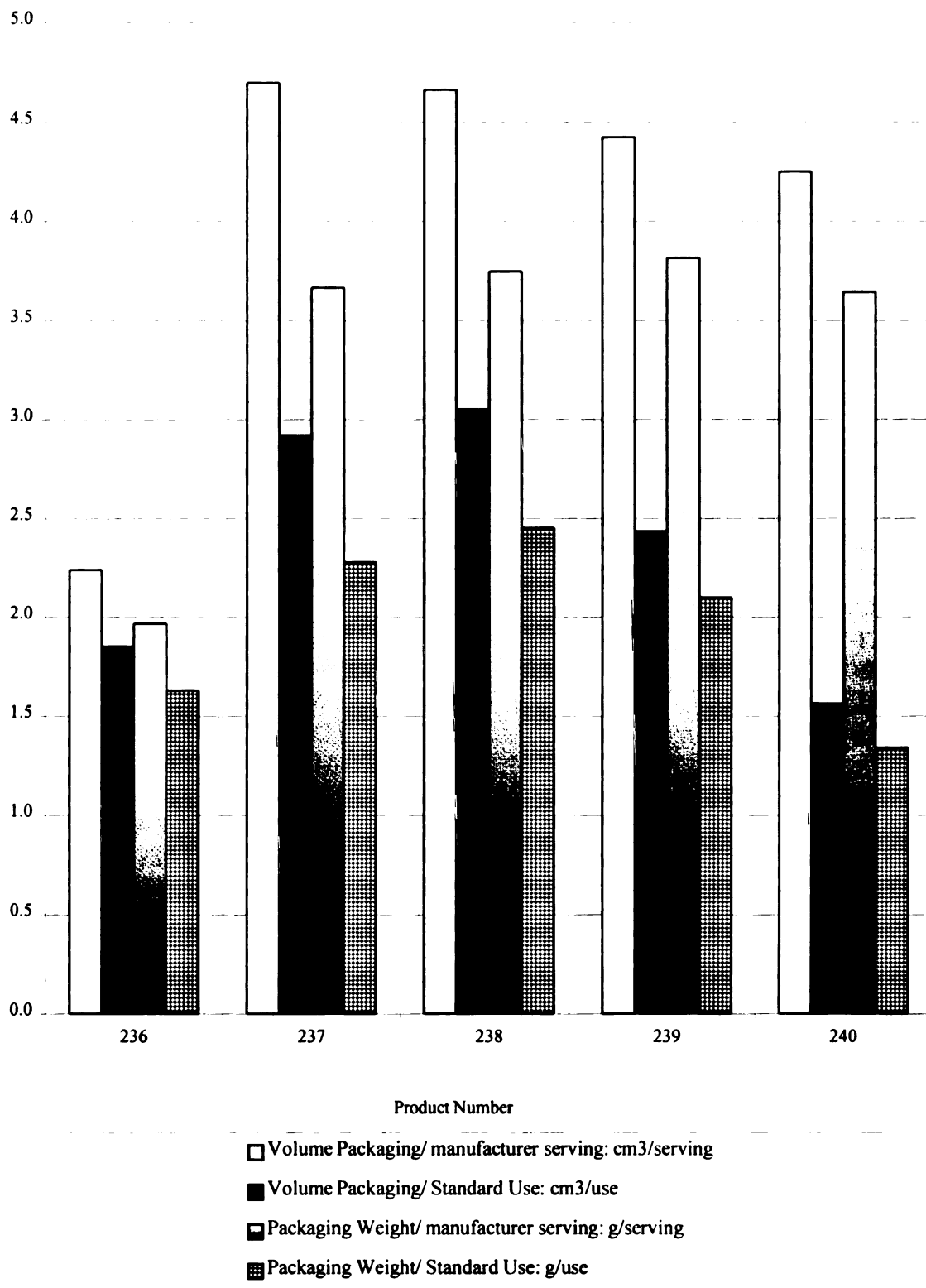


Figure 5.21 Ice Cream Comparative Data

JUICES:

The juice product category consisted of 18 product/package systems and included frozen juice concentrates, shelf-stable juices, and refrigerated juices. The standard use comparison for this product group was based upon 240-ml (8-oz) amount per use. The standard use comparisons for product 90 and 97, the frozen juice concentrates, were based upon the juices in their prepared form. The comparative data for this product group is as follows:

Table 5.25 Juice Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
80	7.387	10.691	0.045	0.186	30.846	44.640
81	9.318	17.893	0.075	0.065	8.083	15.521
82	5.748	5.998	0.025	0.119	27.398	28.589
83	14.722	14.326	0.060	0.051	12.597	12.258
84	19.774	18.898	0.079	0.039	9.814	9.380
85	8.453	8.344	0.035	0.045	10.814	10.676
86	12.712	13.693	0.057	0.044	9.696	10.444
88	38.808	38.604	0.161	0.332	80.096	79.680
89	64.996	72.556	0.302	0.093	20.080	22.415
90	3.647	3.700	0.062	0.078	4.738	4.806
91	10.783	10.858	0.045	0.037	8.764	8.825
92	4.398	4.370	0.018	0.018	4.362	4.334
93	10.015	10.015	0.042	0.040	9.538	9.538
94	13.612	13.612	0.057	0.051	12.260	12.260
96	11.235	11.235	0.048	0.044	10.398	10.563
97	3.079	4.213	0.050	0.071	4.358	4.420
98	26.895	26.895	0.106	0.091	23.013	21.802
99	31.275	30.024	0.125	0.099	24.672	23.684

Product 92 used the least packaging material in the product group on a packaging weight per standard use basis. This product was refrigerated orange juice. The packaging for this product consisted of a high-density polyethylene (HDPE) gallon jug.

Product 88 used the most packaging material in this product group. The package for product 88 consisted of a clear glass bottle with a recloseable metal cap.

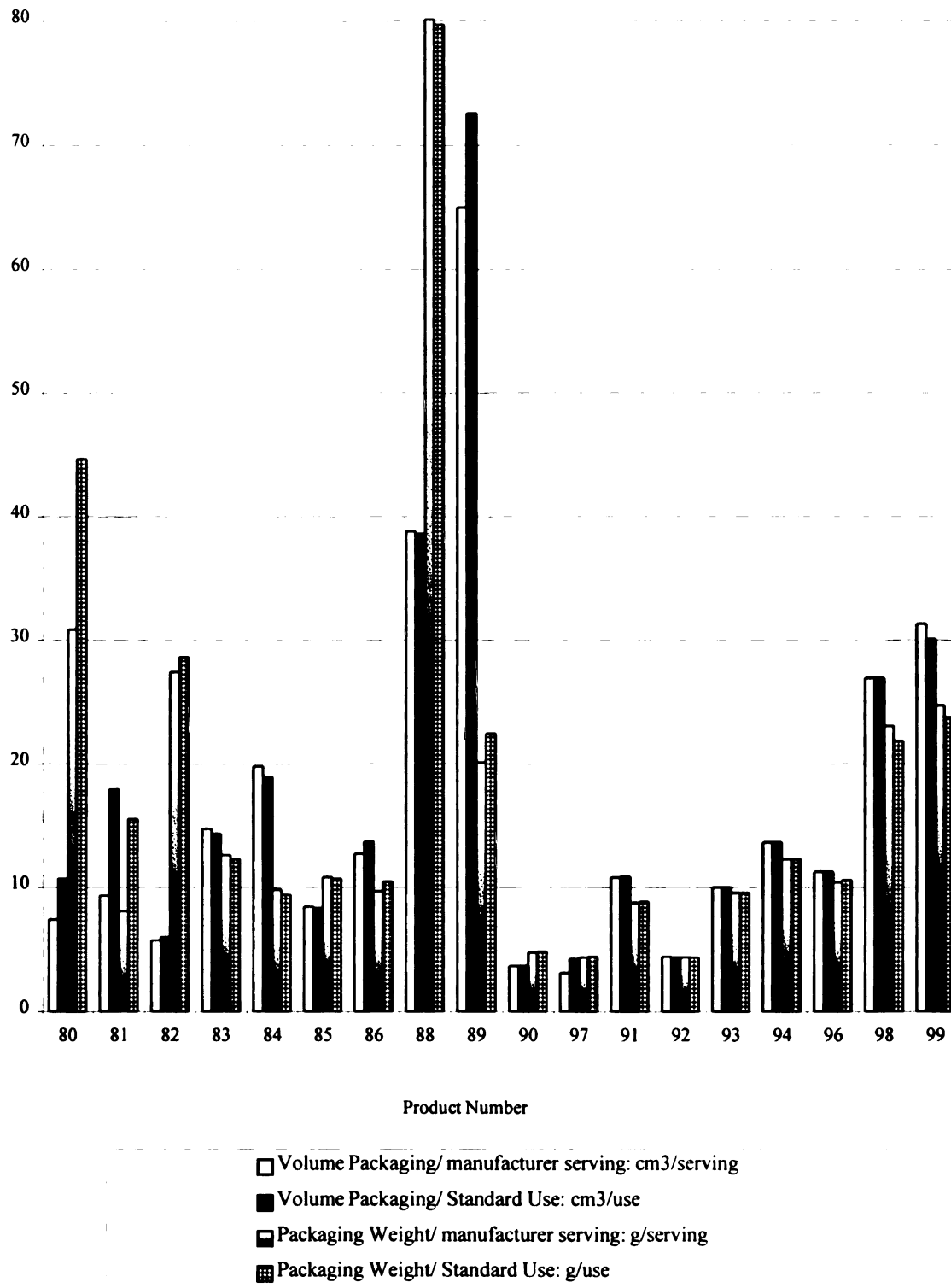


Figure 5.22 Juice Comparative Data

LAUNDRY DETERGENT:

This product category consisted of 7 product/package systems. The comparisons were based upon manufacturer's uses per container and standard uses based upon the amount of product used per wash. The standard use amount for powdered detergent was 62 g per use, and for liquid detergent was 121 ml per use. These values were based upon normal use amounts found during the ad hoc study done for this report.

Table 5.26 Laundry Detergent Comparative Data

Product Number	Volume Packaging/ Manufacturer uses cm3/uses	Volume Packaging/ Standard use cm3/ use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer uses g/uses	Packaging Weight/ Standard use g/ use
110	12.271	11.958	0.099	0.156	19.323	18.83
111	6.630	6.502	0.054	0.067	8.269	8.11
112	8.820	8.702	0.072	0.045	5.519	5.445
			cm3/g	g/g		
113	5.444	5.427	0.088	0.076	4.726	4.711
114	8.075	7.120	0.115	0.102	7.175	6.326
115	0.406	0.401	0.006	0.007	0.432	0.427
116	8.209	7.857	0.127	0.088	5.714	5.469

Product 115 used the least packaging material for this product group. This package consisted of an LDPE plastic sealed bag. The package was sealed on the top, bottom and vertically on the back with a fin seal. Product 110 used the most packaging material in the product group. This package consisted of an HDPE pigmented plastic bottle and a plastic screw cap.

LAUNDRY DETERGENT:

The packaging weight measurements for products 110,111,112 in the laundry detergent group were found to be incorrect. The product assignments of least and most packaging material did not change due to these errors. The errors can most likely be attributed to incorrect scale calibrations.

Table 1: Laundry Detergent Comparative Data

Product Number	Volume Packaging/ Manufacturer uses	Volume Packaging/ Standard use	Volume Packaging/ ml product	Packaging Weight/ ml product	Packaging Weight/ Manufacturer uses	Packaging Weight/ Standard use
	cm3/uses	cm3/ use	cm3/ml	g/ml	g/uses	g/ use
110	12.271	11.958	0.099	0.156	19.323	18.83
111	6.630	6.502	0.054	0.067	8.269	8.11
112	8.820	8.702	0.072	0.045	5.519	5.445
			cm3/g	g/g		
113	5.444	5.427	0.088	0.076	4.726	4.711
114	8.075	7.120	0.115	0.102	7.175	6.326
115	0.406	0.401	0.006	0.007	0.432	0.427
116	8.209	7.857	0.127	0.088	5.714	5.469

Table 2: Corrected Laundry Detergent Comparative Data

Product Number	Volume Packaging/ Manufacturer uses	Volume Packaging/ Standard use	Volume Packaging/ ml product	Packaging Weight/ ml product	Packaging Weight/ Manufacturer uses	Packaging Weight/ Standard use
	cm3/uses	cm3/ use	cm3/ml	g/ml	g/uses	g/ use
110	12.271	11.958	0.099	0.073	9.008	8.778
111	6.630	6.502	0.054	0.051	6.328	6.207
112	8.820	8.702	0.072	0.034	4.135	4.080
			cm3/g	g/g		
113	5.444	5.427	0.088	0.076	4.726	4.711
114	8.075	7.120	0.115	0.102	7.175	6.326
115	0.406	0.401	0.006	0.007	0.432	0.427
116	8.209	7.857	0.127	0.088	5.714	5.469

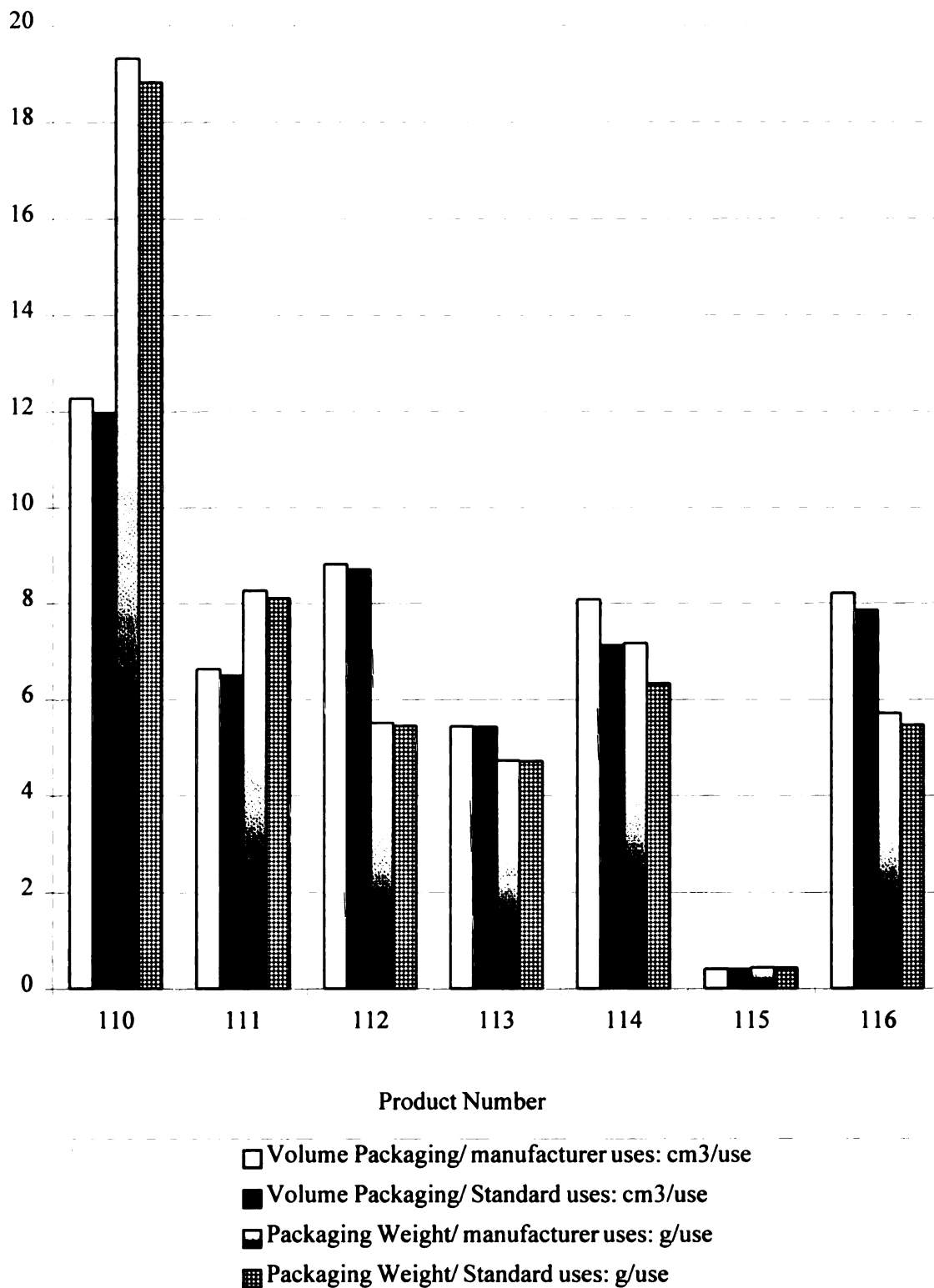


Figure 5.23 Laundry Detergent Comparative Data

LUNCH MEAT:

The lunch meat product group consisted of 4 product/package systems. The lunch meat product selected was ham.

Table 5.27 Lunch Meat Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
157	0.373	0.881	0.013	0.015	0.438	1.036
<i>158</i>	<i>6.884</i>	<i>10.960</i>	<i>0.115</i>	<i>0.110</i>	<i>6.570</i>	<i>10.461</i>
159	1.403	2.658	0.027	0.044	2.263	4.285
160	0.637	2.081	0.026	0.023	0.564	1.842

Product 157 used the least packaging material for this product group. This package consisted of a plastic LDPE sealed pouch. Product 158 used the most packaging in the product group. The package consisted of a paperboard outer carton and a plastic pouch that was sealed on 4 sides.

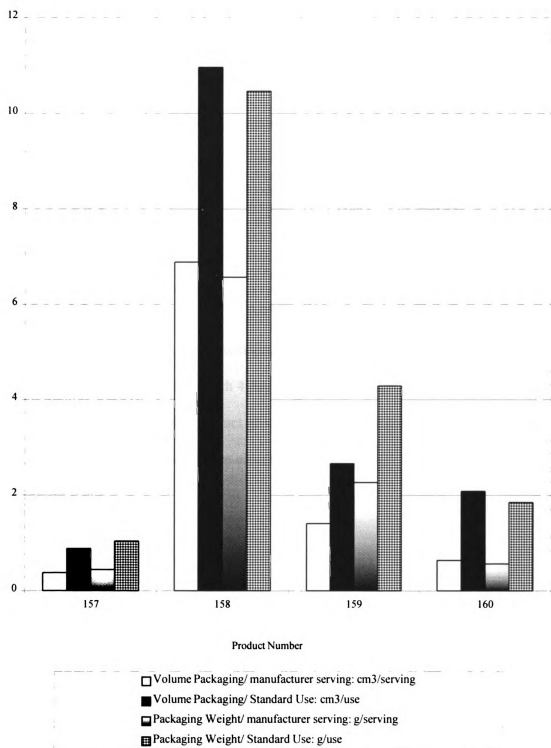


Figure 5.24 Lunch Meat Comparative Data

MARGARINE:

The margarine product group consisted of 5 product/package systems. The product group consisted of margarine sticks, margarine tubs and squeezable margarine. The standard use comparison was not used because the category included no calorie fat-free margarine.

Table 5.28 Margarine Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
167	1.735	*	0.119	0.097	1.409	*
168	0.794	*	0.055	0.050	0.721	*
169	1.720	*	0.115	0.121	1.803	*
170	0.955	*	0.063	0.043	0.652	*
257	0.784	*	0.055	0.045	0.650	*

Product 257 used the least packaging material in the product group. This package consisted of a paperboard carton with 4 paper margarine wraps. Product 169 used the most packaging material in the product group. This package consisted of a squeezable HDPE plastic bottle, a plastic flip top closure and a foil seal.

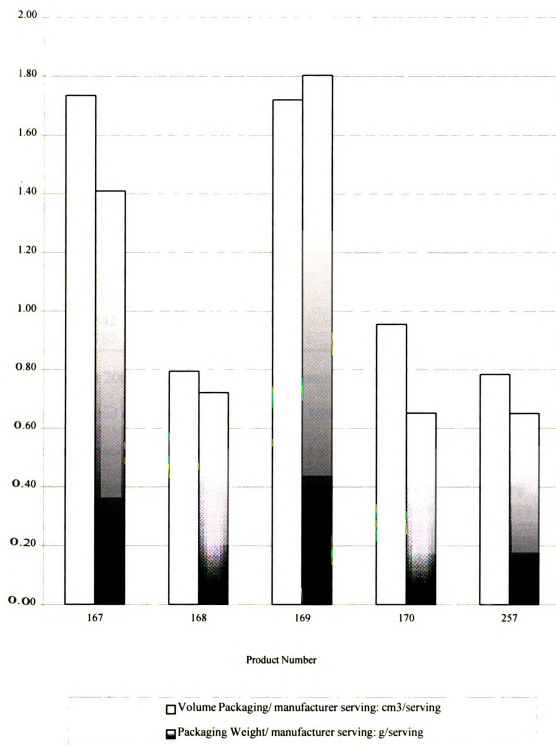


Figure 5.25 Margarine Comparative Data

MEAT:

The meat category consisted of 4 product/package systems. The product selected for analysis in this study was ground beef. The calorie and serving size information for the manufacturer and standard use comparisons were taken from information provided in grocery stores by the Food Marketing Institute. The expanded polystyrene trays found in this product group were analyzed without being compacted.

Table 5.29 Meat Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
198	27.495	13.514	0.227	0.027	3.325	1.634
199	33.777	16.039	0.270	0.034	4.273	2.029
200	13.342	3.954	0.094	0.009	1.234	0.366
201	15.767	5.139	0.123	0.013	1.626	0.530

Product 200 used the least packaging material in this product group. This package consisted of an expanded polystyrene (EPS) tray and plastic wrap. Product 199 used the most packaging material in this product group. This package consisted of an EPS tray, and plastic outer sealing layers. This package also had a paper backing material inside the package.

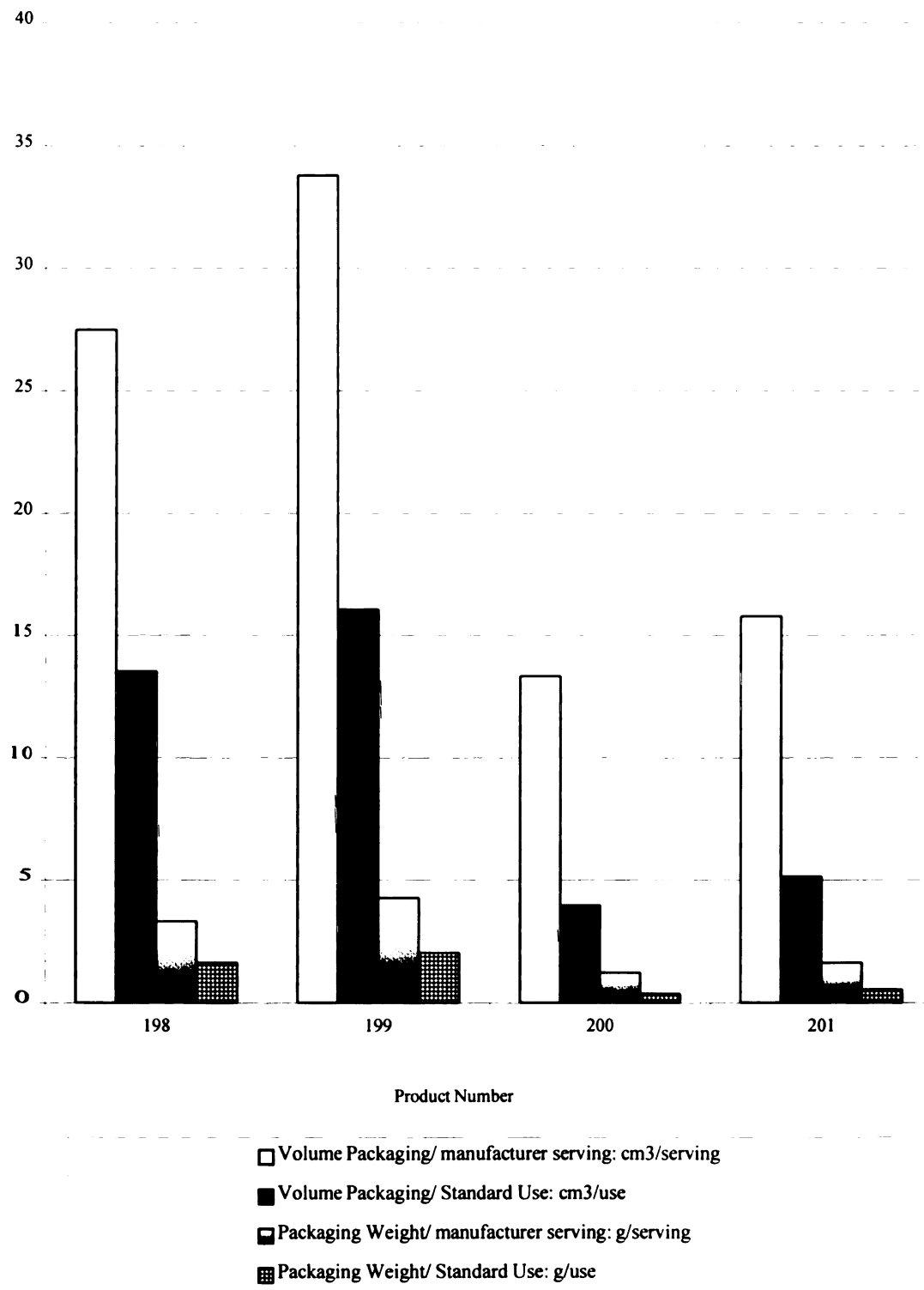


Figure 5.26 Meat Comparative Data

MILK:

This product group consisted of 9 product/package systems. The product group consisted of skim and low fat milks.

Table 5.30 Milk Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
161	5.269	6.586	0.022	0.018	4.404	5.505
162	4.391	5.553	0.019	0.018	4.217	5.334
163	10.190	12.567	0.042	0.033	7.918	9.765
164	11.072	13.883	0.046	0.035	8.415	10.552
165	9.434	11.792	0.039	0.062	14.910	18.638
166	12.502	10.418	0.052	0.064	15.405	12.838
251	11.764	13.167	0.049	0.056	13.380	14.976
252	21.482	16.617	0.090	0.095	22.768	17.612
260	1.621	1.366	0.007	0.007	1.550	1.307

Product 260 was found to use the least packaging material in this product group.

This package consisted of an LDPE plastic pouch. Product 252 was found to use the most packaging material in the group on a packaging weight per manufacturer serving basis. This basis was used for this category because the milk caloric values varied between skim and low fat milk products. The package for this product consisted of 6 individual serving pigmented HDPE bottles, 6 plastic shrink labels, and plastic outer shrink-wrap.

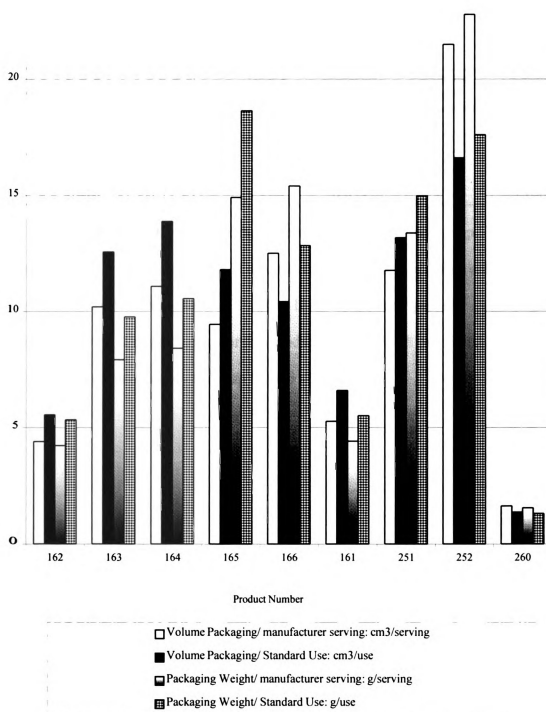


Figure 5.27 Milk Comparative Data

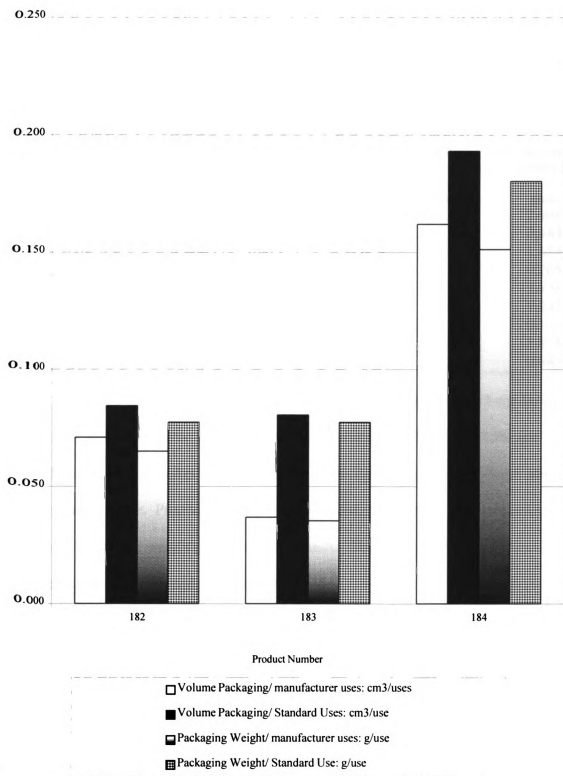
PAPER TOWEL:

The paper towel product group consisted of 3 product/package systems. The **standard** use comparison was based upon one 11 inch x11 inch (27.9 cm x 27.9 cm) paper **towel** per use.

Table 5.31 Paper Towel Comparative Data

Product Number	Volume Packaging/ Manufacturer use cm3/ use	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ one sheet, cm2 cm3/cm2	Packaging Weight/ one sheet, cm2 g/cm2	Packaging Weight/ Manufacturer use g/use	Packaging Weight/ Standard Use g/use
182	0.071	0.084	0.017	0.016	0.065	0.077
183	0.037	0.081	0.015	0.015	0.035	0.077
184	0.162	0.193	0.106	0.099	0.151	0.180

Product 183 used the least packaging material in this product group. The **packaging** for this product consisted of an outer LDPE plastic wrap. This product **consisted** of one roll of paper towels. Product 184 used the most packaging materials in **this** product group. The packaging for this product consisted of 8 individual LDPE **plastic** wraps, and an outer plastic wrap around all 8 rolls.



5.28 Paper Towel Comparative Data

PASTA:

The pasta category consisted of 9 product/packaging systems. The expanded polystyrene (EPS) tray found in this product group was analyzed without being compacted. The comparative data for the group is as follows:

Table 5.32 Pasta Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer Serving g/serving	Packaging Weight/ Standard Use g/use
50	7.408	3.605	0.1328	0.1071	5.975	2.908
51	9.501	4.630	0.1684	0.0176	0.993	0.484
52	4.273	2.006	0.0752	0.0618	3.511	1.684
53	0.490	0.228	0.0086	0.0077	0.440	0.205
54	6.316	2.606	0.0705	0.0936	8.380	3.458
55	3.818	1.727	0.0691	0.0777	4.293	1.942
56	0.582	0.278	0.0102	0.0054	0.305	0.146
57	62.637	30.096	1.056	0.0651	3.863	1.856
58	1.548	0.720	0.027	0.0318	1.827	0.849

Product 56 used the least packaging for this product group. The package for this product consisted of a plastic pillow pouch with a vertical fin seal. Product 56 was selected for the market basket analysis because of smallest packaging weight per standard use comparison value. Product 54 used the most packaging material in this product group on a packaging weight per standard use basis. The package for this product consisted of a plastic tray and a plastic film cover.

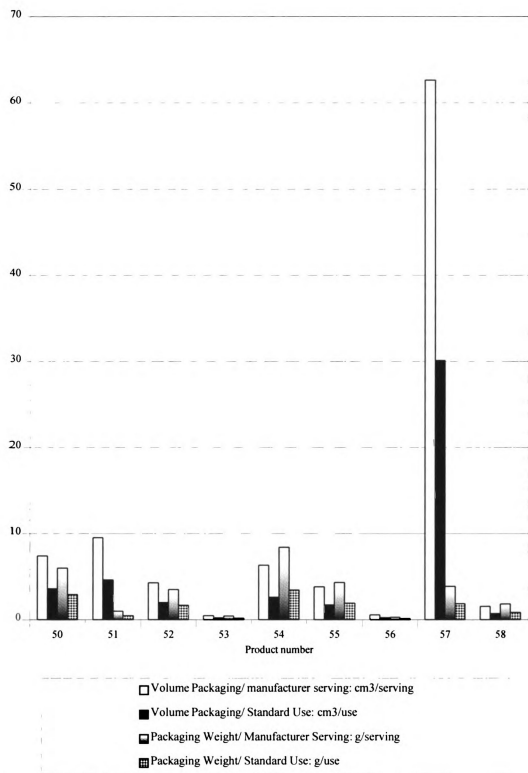


Figure 5.29 Pasta Comparative Data

PET FOOD:

The pet food product category consisted of 9 product/package systems. The pet food product selected for analysis in this study was cat food. Included in this category were moist and dry cat foods. The manufacturer serving comparisons were not used in this product category because the majority of the products did not indicate a serving size. The standard use comparison was based upon normal feeding amounts for one cat per day. The ad hoc study determined that the basis for the standard use comparison was 5.5oz (155g) for moist food and 2.1oz (61.6g) for dry.

Table 5.33 Pet Food Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/servings	Volume Packaging/ Standard Use cm3/uses	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/servings	Packaging Weight/ Standard Use g/uses
59	*	6.657	0.108	0.097	*	5.969
60	*	5.185	0.033	0.146	*	22.678
61	*	5.239	0.034	0.227	*	35.157
62	*	10.213	0.166	0.141	*	8.676
63	*	1.550	0.025	0.023	*	1.389
64	*	7.586	0.049	0.114	*	17.605
65	*	15.366	0.099	0.093	*	14.388
66	*	4.278	0.069	0.022	*	1.369
67	*	10.357	0.168	0.132	*	8.104

Product 66 used the least packaging material in this product group on a packaging weight per standard use basis. This product was a dry cat food packaged in a multi-wall paper bag. Product 61 used the most packaging material on a packaging weight per standard use basis and, therefore, was selected for the market basket. The package for Product 61 consisted of a 2-piece steel can with a pull-top lid and a paper label.

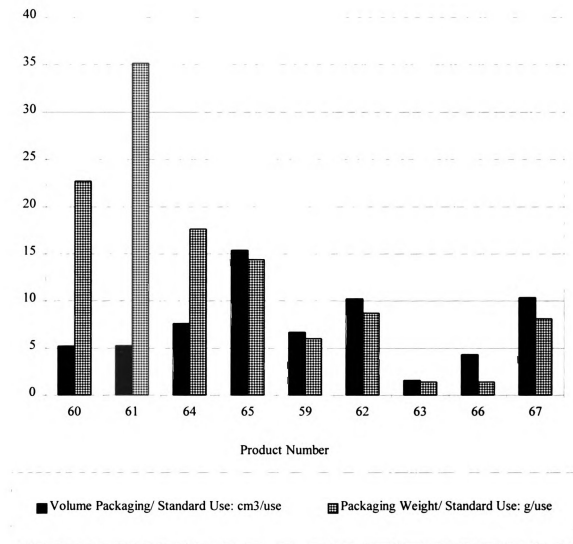


Figure 5.30 Pet Food Comparative Data

POULTRY:

The poultry product category consisted of two product/package systems. This product group was made up only of fresh, whole chicken. This was done to narrow the product group because of the vast variety of prepared chicken products available, such as breaded chicken breast and buffalo-wing style chicken pieces. The expanded polystyrene tray in this product group was analyzed in a non-compacted form. The calorie and serving size information for the manufacturer and standard use comparisons were taken from information provided in grocery stores by the Food Marketing Institute.

Table 5.34 Poultry Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm ³ /serving	Volume Packaging/ Standard Use cm ³ /use	Volume Packaging/ Product Weight cm ³ /g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
202	0.348	0.246	0.004	0.003	0.309	0.219
<i>203</i>	<i>11.733</i>	<i>8.536</i>	<i>0.136</i>	<i>0.017</i>	<i>1.443</i>	<i>1.050</i>

Product 202 used the least packaging material for the product group. The package for this product consisted of a single LDPE plastic bag. Product 203 used the most packaging material for the product group. This package consisted of an expanded polystyrene tray, a plastic label, and an outer plastic wrap.

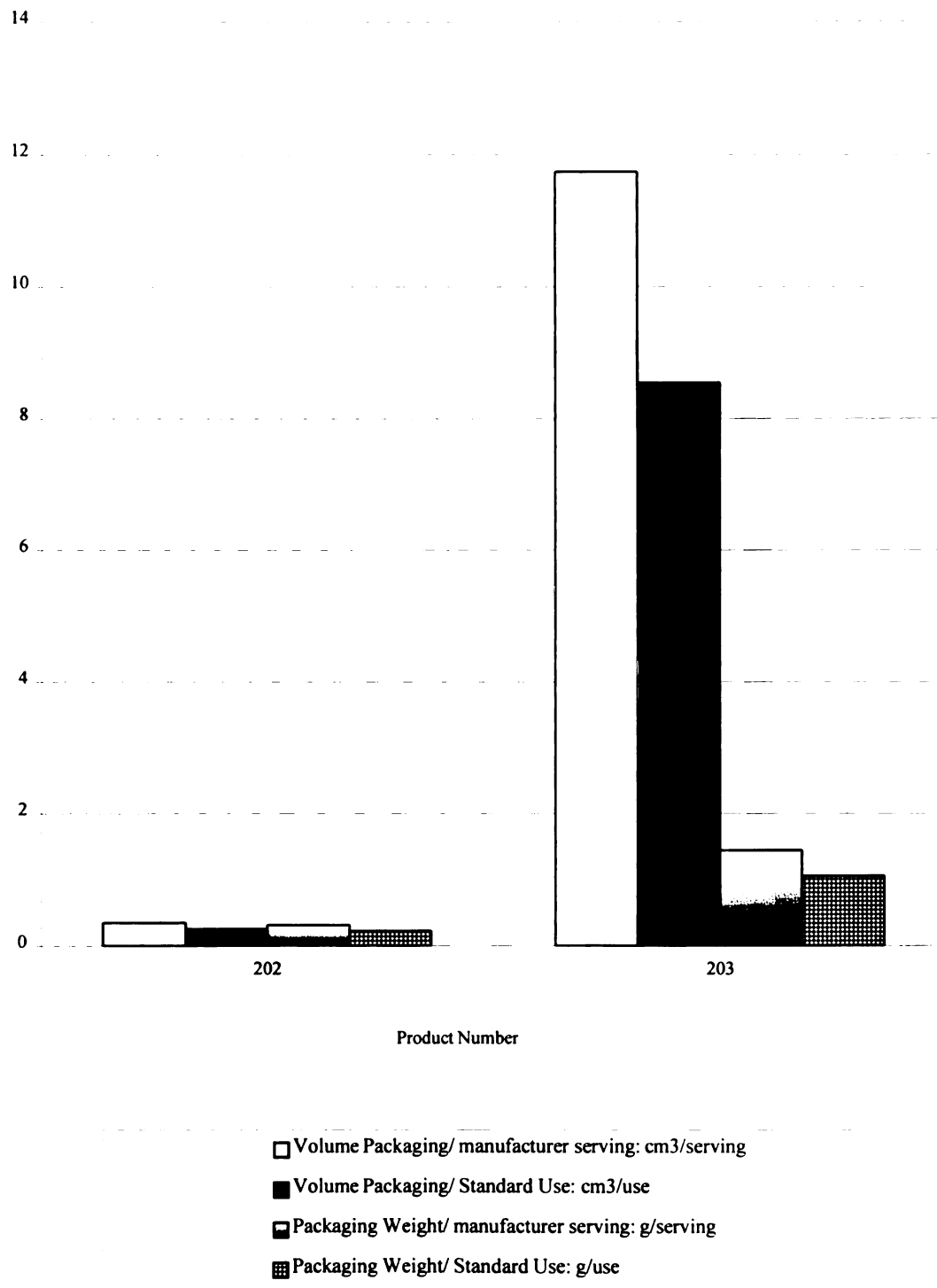


Figure 5.31 Poultry Comparative Data

SHAMPOO:

The shampoo category consisted of 4 product/packaging systems. Standard use comparisons for this product category were based upon the amount of shampoo used per wash. The amount of shampoo used for the standard use basis in this study was 10 ml/use. This is based upon normal use amounts determined in the ad hoc study for this report.

Table 5.35 Shampoo Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml Product cm3/ml	Packaging Weight/ ml Product g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
232	0.559	0.931	0.093	0.103	0.620	1.033
233	0.387	0.626	0.063	0.081	0.501	0.811
234	1.191	1.854	0.185	0.153	0.985	1.534
235	<i>1.109</i>	<i>1.706</i>	<i>0.171</i>	<i>0.162</i>	<i>1.050</i>	<i>1.615</i>

Product 233 used the least packaging material in this product group. This package consisted of a polyethylene terephthalate (PET) plastic bottle and a plastic screw cap. Product 235 used the most packaging material in this product group. This package consisted of a high-density polyethylene (HDPE) bottle with plastic flip cap. Product 235 was selected for market basket analysis because of the largest packaging weight per standard use comparison value.

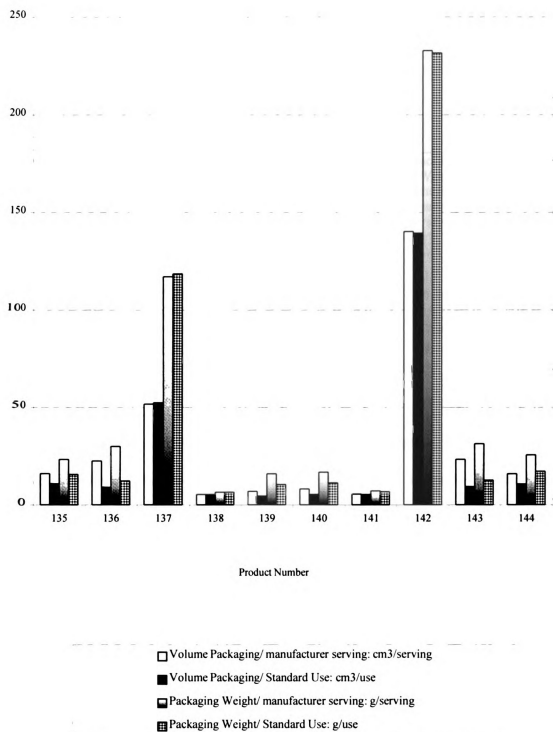


Figure 5.32 Shampoo Comparative Data

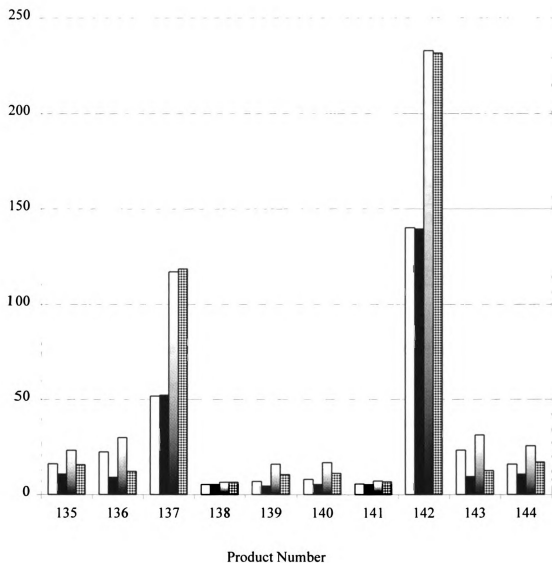
SOFT DRINK:

The soft drink product group consisted of 10 product/package systems. The standard use comparisons were based upon 240 ml (8 fl oz) per usage. The standard use comparison was not based on calories per serving because the category included diet soft drinks.

Table 5.36 Soft Drink Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ ml Product cm3/ml	Packaging Weight/ ml Product g/ml	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
135	16.011	10.764	0.045	0.065	23.211	15.604
136	22.329	9.045	0.038	0.050	29.917	12.118
137	51.600	52.253	0.218	0.494	117.008	118.489
138	5.257	5.291	0.022	0.027	6.419	6.461
139	6.794	4.457	0.019	0.043	15.860	10.405
140	8.020	5.347	0.022	0.046	16.697	11.131
141	5.527	5.202	0.022	0.028	7.158	6.736
142	140.212	139.438	0.581	0.965	232.797	231.510
143	23.275	9.310	0.039	0.052	31.330	12.532
144	15.895	10.626	0.044	0.071	25.499	17.047

Product 138 used the least packaging material in the product group. Product 138 consisted of a 3-Liter PET bottle. Product 138 was selected for market basket analysis because of the smallest packaging weight per standard use comparison value. Product 142 used the most packaging material in this product group. The packaging consisted of 6 clear glass bottles and a paperboard carton.



- Volume Packaging/ manufacturer serving: cm3/serving
- Volume Packaging/ Standard Use: cm3/use
- ▒ Packaging Weight/ manufacturer serving: g/serving
- ▓ Packaging Weight/ Standard Use: g/use

Figure 5.33 Soft Drink Comparative Data

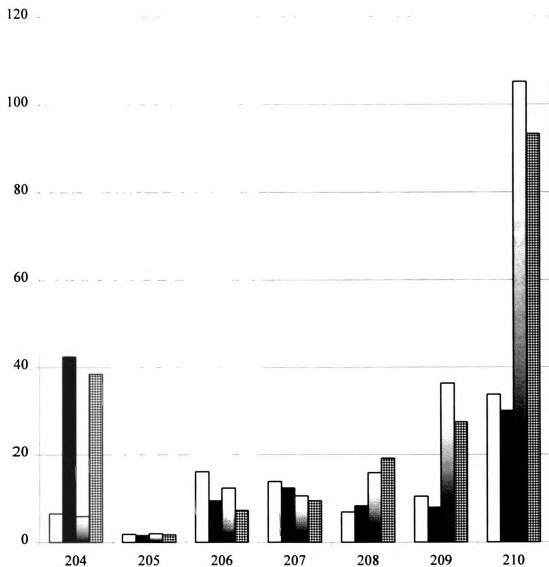
SOUP:

The soup product group consisted of 7 product/package systems. Included in this group were condensed soups, dry soups, ready to eat soups, and frozen soups.

Table 5.37 Soup Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
204	6.519	42.406	0.444	0.402	5.903	38.395
205	1.798	1.540	0.055	0.059	1.955	1.675
206	16.118	9.430	0.329	0.251	12.320	7.208
207	13.881	12.329	0.116	0.088	10.590	9.406
208	6.840	8.259	0.056	0.129	15.856	19.144
209	10.476	7.912	0.038	0.132	36.245	27.373
<i>210</i>	<i>33.749</i>	<i>29.930</i>	<i>0.146</i>	<i>0.454</i>	<i>105.177</i>	<i>93.276</i>

Product 205 used the least packaging material for this product group. The **package** consisted of a single paper/plastic/foil laminate pouch. This product was one of **the** dry soups in the product group. Product 210 used the most packaging material in the **product** group. The package consisted of a clear glass jar with a metal lug closure and a **paper** label. This product was one of the ready-to-eat soups in the product group.



Product Number

- Volume Packaging/ manufacturer serving: cm3/serving
- Volume Packaging/ Standard Use: cm3/use
- ▤ Packaging Weight/ manufacturer serving: g/serving
- ▥ Packaging Weight/ Standard Use: g/use

Figure 5.35 Soup Comparative Data

TISSUES:

The tissue product group consisted of 6 product/packaging systems. The standard use comparison was based upon 1 sq. ft. of tissue per use. Manufacturer uses comparisons were based upon one tissue per use. The data comparisons for this product group is as follows:

Table 5.38 Tissue Comparative Data

Product Number	Volume Packaging/ Manufacturer use cm ³ /use	Volume Packaging/ Standard Uses cm ³ /use	Volume Packaging/ cm ² product cm ³ /cm ²	Packaging Weight/ cm ² product g/cm ²	Packaging Weight/ Manufacturer use g/use	Packaging Weight/ Standard Use g/use
122	0.067	0.129	0.017	0.061	0.243	0.471
123	0.904	1.821	0.116	0.091	0.714	1.438
124	0.496	0.954	0.107	0.090	0.418	0.804
125	0.613	1.228	0.159	0.135	0.520	1.043
126	0.516	0.983	0.186	0.154	0.425	0.811
127	0.208	0.393	0.030	0.034	0.230	0.435

Product 127 used the least packaging material in this product group. This package consisted of 6 individual plastic tissue pack wraps, and an outer plastic wrap. Product 127 was selected for market basket analysis because of the smallest packaging weight per standard use comparison value. Product 123 used the most packaging material in the product group on a packaging weight per standard use basis. This package consisted of paperboard box with a plastic wrap material around the width of the box, with a plastic adhesive label.

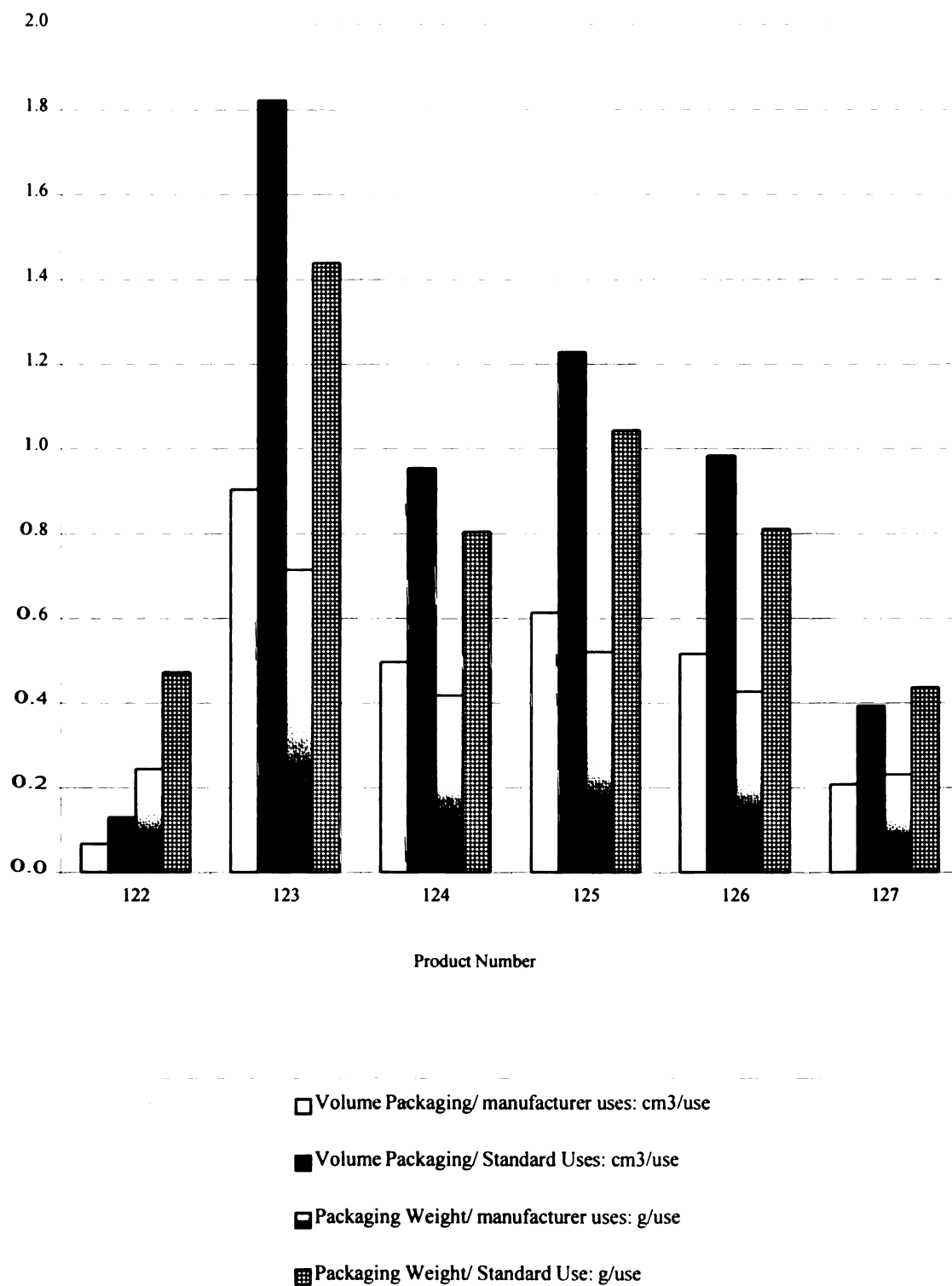


Figure 5.35 Tissue Comparative Data

TOILET TISSUE:

The toilet paper product category consisted of 3 product/package systems. The standard use comparison was based upon 1 sq. ft. of toilet tissue per use. Manufacturer uses comparisons were based upon on one square of toilet tissue per use.

Table 5.39 Toilet Tissue Comparative Data

Product Number	Volume Packaging/ Manufacturer uses cm ³ /use	Volume Packaging/ Standard Uses cm ³ /use	Volume Packaging/ cm ² product cm ³ /cm ²	Packaging Weight/ cm ² product g/cm ²	Packaging Weight/ Manufacturer uses g/use	Packaging Weight/ Standard Use g/use
128	0.015	0.102	0.061	0.068	0.016	0.113
129	0.004	0.030	0.109	0.098	0.004	0.027
130	0.033	0.236	0.254	0.032	0.004	0.029

Product 129 used the least packaging material in this product group. This product contained 12 rolls of toilet paper. The package consisted of an outer plastic (LDPE) wrap. Product 128 used the most packaging material in this product group. Product 128 was found to produce the most packaging on the packaging weight per standard use basis, and, therefore, was selected for the market basket. The package for product 128 consisted of 4 toilet paper rolls wrapped with an outer plastic wrap.

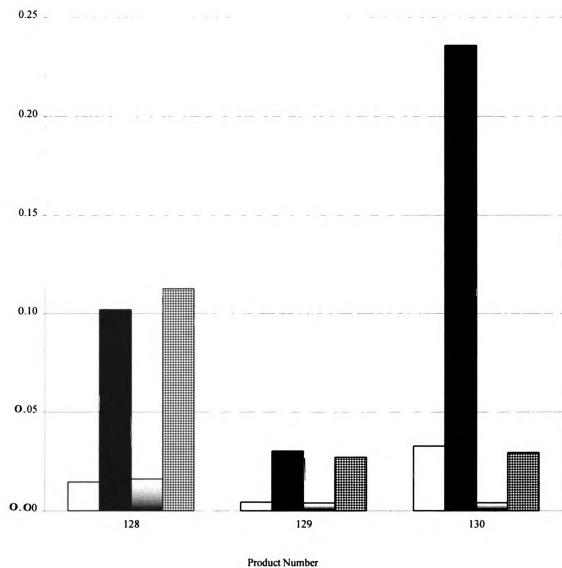


Figure 5.36 Toilet Tissue Comparative Data

TOMATO PRODUCT:

The representative product for the tomato product group was ketchup. The product group consisted of 4 product/package systems. Glass ketchup bottles were not included in this study because none could be found in retail outlets. The standard use comparison was not used in this analysis since ketchup is not being used for the nutritional value, but rather used for flavoring. The comparative data for the product group is as follows:

Table 5.40 Tomato Product Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
194	0.660	*	0.038	0.052	0.895	*
<i>195</i>	<i>0.971</i>	*	<i>0.055</i>	<i>0.074</i>	<i>1.305</i>	*
196	0.848	*	0.056	0.059	0.890	*
197	1.251	*	0.072	0.064	1.102	*

Product 194 used the least packaging material in this product group. The product was a 64 fluid ounce bottle of ketchup. The packaging for this product was a PET plastic bottle with a foil top seal and a polypropylene (PP) flip-top cap. Product 195 used the most packaging in this product group. Product 195 was selected because of the largest packaging weight per manufacturer serving comparative value in the group. Product 195 was packaged in a PET bottle with a foil seal and a polypropylene (PP) flip-top closure. The product was a 20 fluid ounce bottle of ketchup.

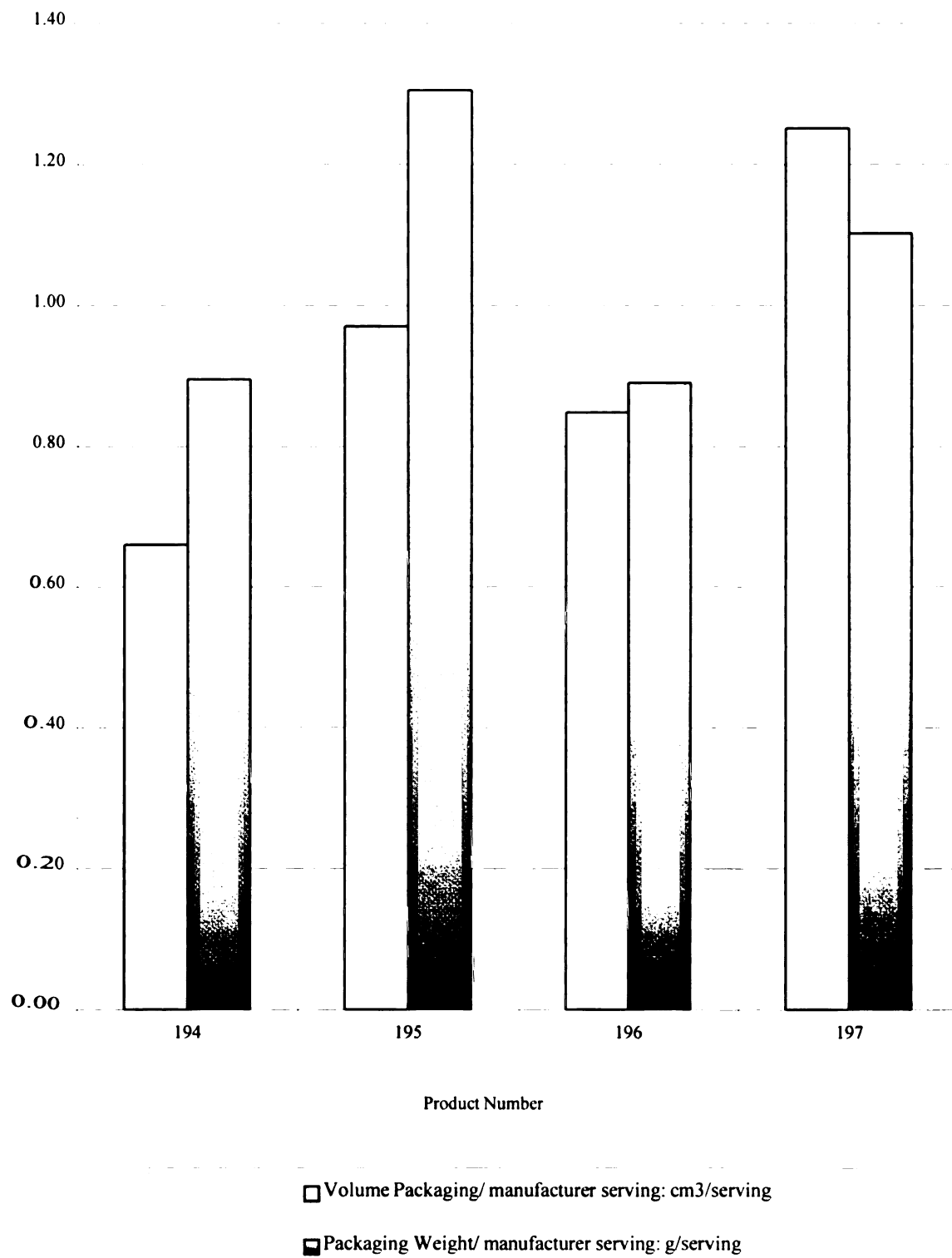


Figure 5.37 Tomato Product Comparative Data

TOOTHPASTE:

The toothpaste product category consisted of 6 product/package systems. The standard use comparison was based upon the amount of toothpaste consumed per use, which was found to be 1.572 grams. This amount was based upon normal use amounts for Aaron Fitchko, the researcher in this project.

Table 5.41 Toothpaste Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
226	0.235	0.237	0.150	0.140	0.219	0.220
227	0.272	0.245	0.156	0.129	0.226	0.203
228	0.730	0.593	0.378	0.357	0.691	0.562
229	0.219	0.202	0.128	0.099	0.170	0.156
230	0.291	0.276	0.175	0.171	0.283	0.268
231	2.385	2.173	1.382	1.276	2.202	2.006

Product 229 was found to use the least packaging material for this product group. The package for this product consisted of a plastic self-standing tube with a flip-top closure and a foil seal. Product 231 used the most packaging material in this product group. This package consisted of a paperboard box and a two piece plastic pump. The pump consisted of a plastic bottom base and a plastic top pump piece.

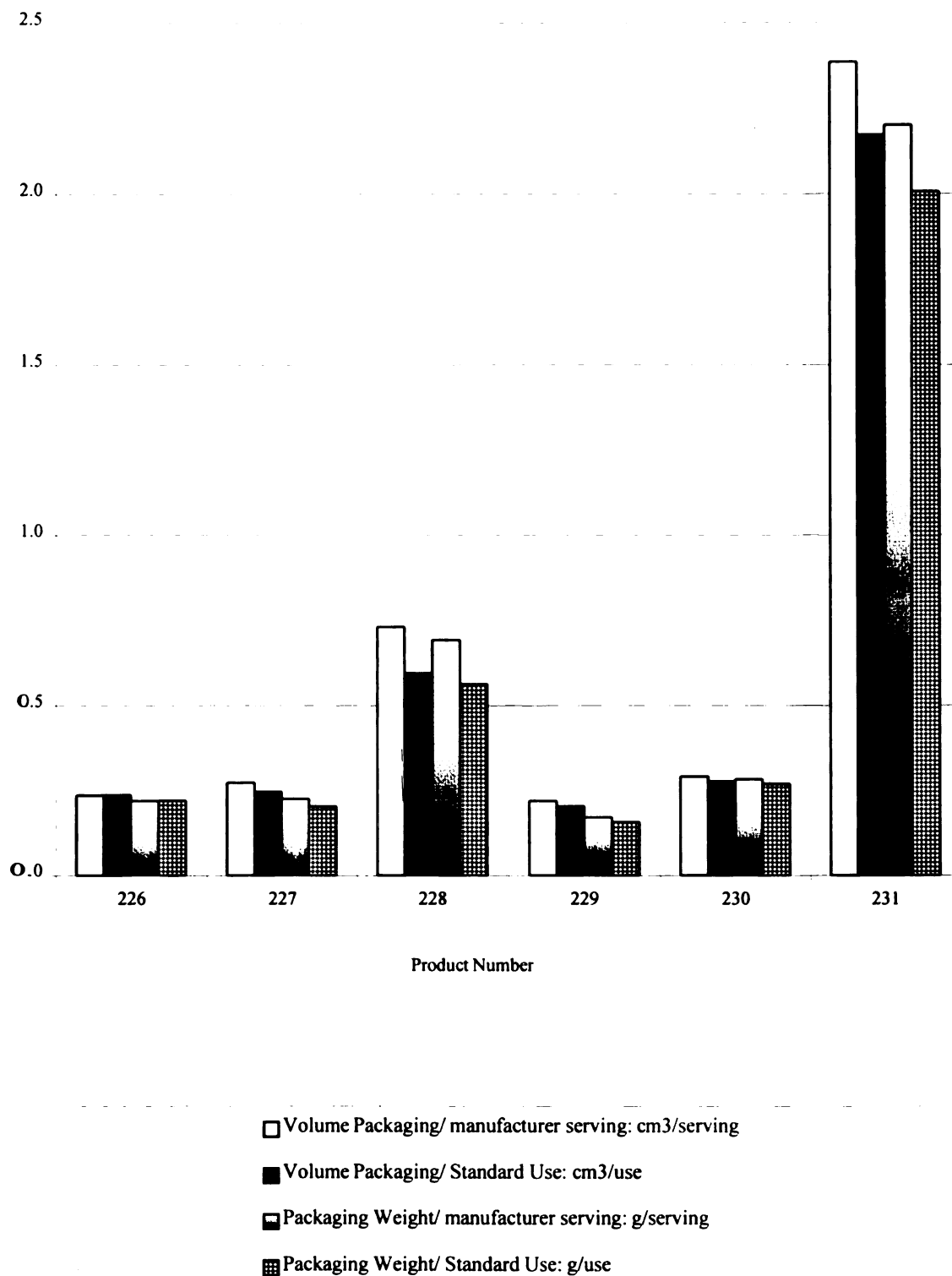


Figure 5.38 Toothpaste Comparative Data

TUNA FISH:

The tuna fish product group consisted of 4 product/package systems. The tuna fish product selected for analysis in this study was tuna fish packed in spring water.

Table 5.42 Tuna Fish Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
241	3.020	2.500	0.042	0.181	12.852	10.640
242	5.602	6.236	0.066	0.350	29.905	33.293
255	1.730	2.320	0.025	0.154	10.714	14.367
256	27.083	30.509	0.321	0.569	47.945	54.009

Product 241 used the least packaging material in this product group based on packaging weight per standard use. This package consisted of a 6-ounce two-piece steel can with a paper label. Product 256 used the most packaging material in the product group. This product consisted of 3 two-piece steel cans with pull-tab lids, 3 paper labels, 3 plastic PET containers, 3 plastic seals on the PET containers, and a paperboard carton. This product was a lunch pack variety of tuna fish.

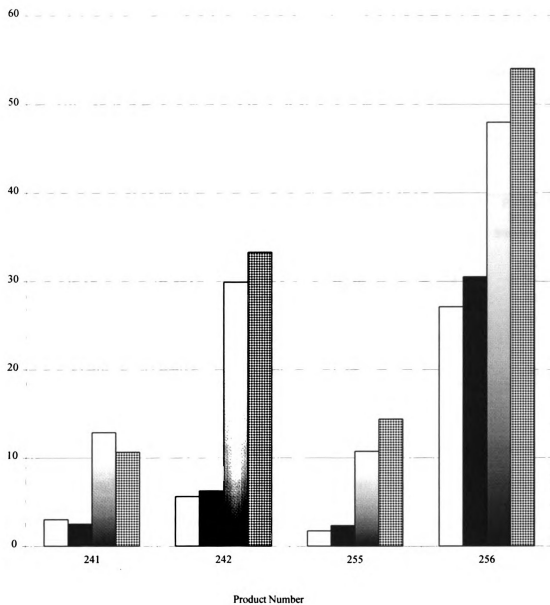


Figure 5.39 Tuna Fish Comparative Data

VEGETABLES:

The vegetable product group consisted of 6 product/package systems. Included in this product group were canned vegetables, fresh vegetables and frozen vegetables. The products selected included peas and carrots. The calorie information for the fresh vegetables included in this product group was from information available in the grocery stores from the United States Food and Drug Administration.

Table 5.43 Vegetable Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
219	0.334	0.921	0.004	0.004	0.320	0.882
220	0.661	1.573	0.007	0.006	0.606	1.443
222	0.907	2.358	0.010	0.010	0.958	2.491
223	6.712	19.471	0.055	0.129	15.620	45.313
224	4.472	14.425	0.036	0.127	15.735	50.758
225	7.628	9.897	0.078	0.063	6.137	7.962

Product 219 used the least packaging material in this product group. The package consisted of a single low-density polyethylene (LDPE) bag. Product 224 used the most packaging material in this product group. Product 224 was selected for analysis in the market basket on a packaging weight per standard use basis. The package for product 224 consisted of a three-piece steel can and a paper label.

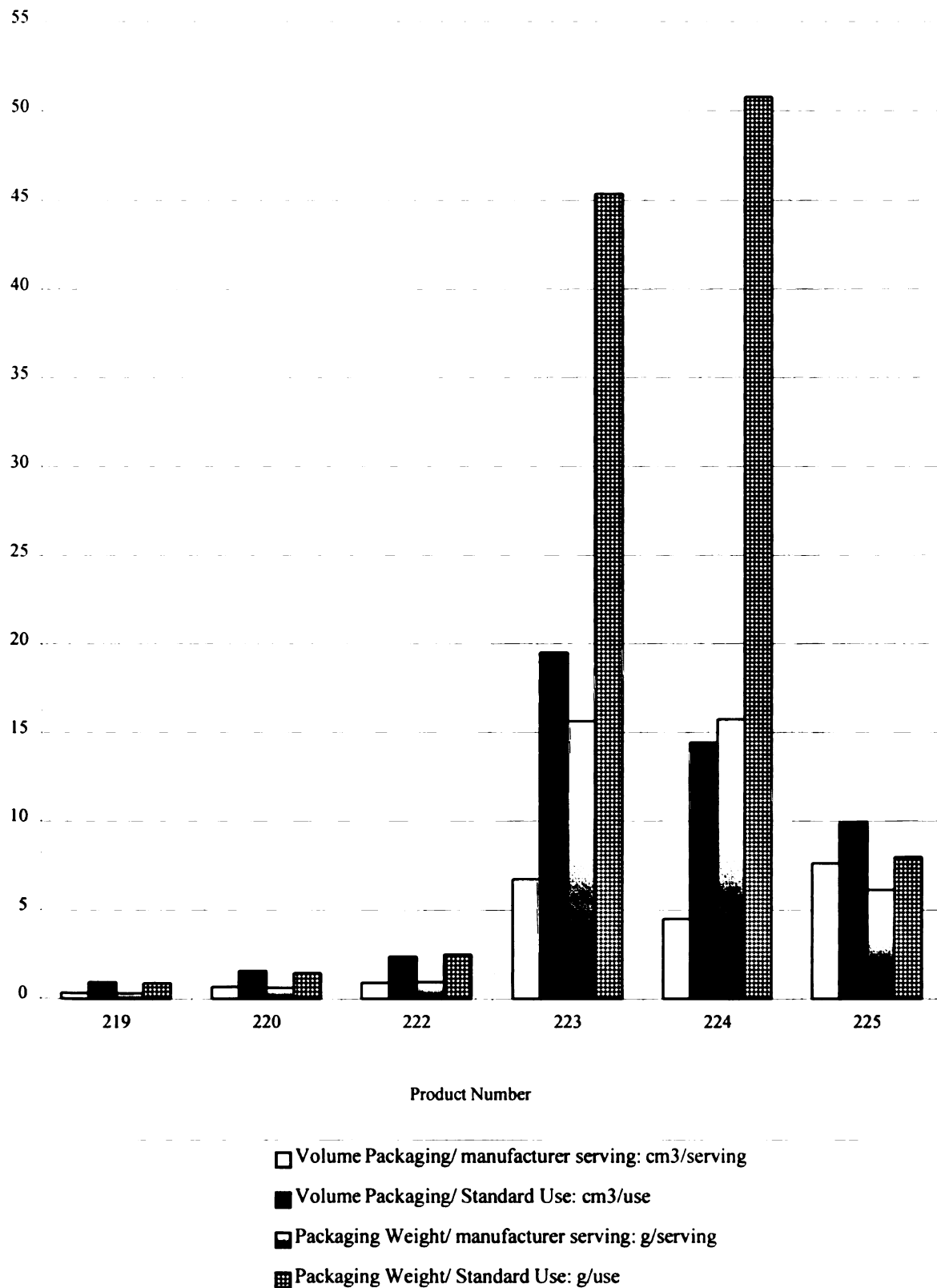


Figure 5.40 Vegetable Comparative Data

WATER:

This product group consisted of 9 product/package systems. The standard use comparison was not used in this product group because water has no calories.

Table 5.44 Water Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ ml product cm3/ml	Packaging Weight/ ml product g/ml	Packaging Weight/ Manufacturer serving g/serving
100	5.305	0.020	0.027	6.933
101	5.969	0.022	0.031	8.308
102	10.389	0.036	0.056	16.159
104	10.970	0.045	0.049	12.062
105	16.686	0.068	0.029	7.212
106	8.834	0.033	0.043	11.449
107	10.090	0.019	0.025	13.163
108	4.509	0.017	0.015	4.057
109	5.302	0.021	0.021	5.443

Product 108 used the least packaging material in this product group. The packaging of this product consisted of a gallon size HDPE plastic bottle. Product 102 used the most packaging material. The packaging of product 102 consisted of 4 plastic PET bottles, and a paperboard carton. This product was selected for the market basket because of the packaging weight per standard use comparative value, which is the largest for the product group.

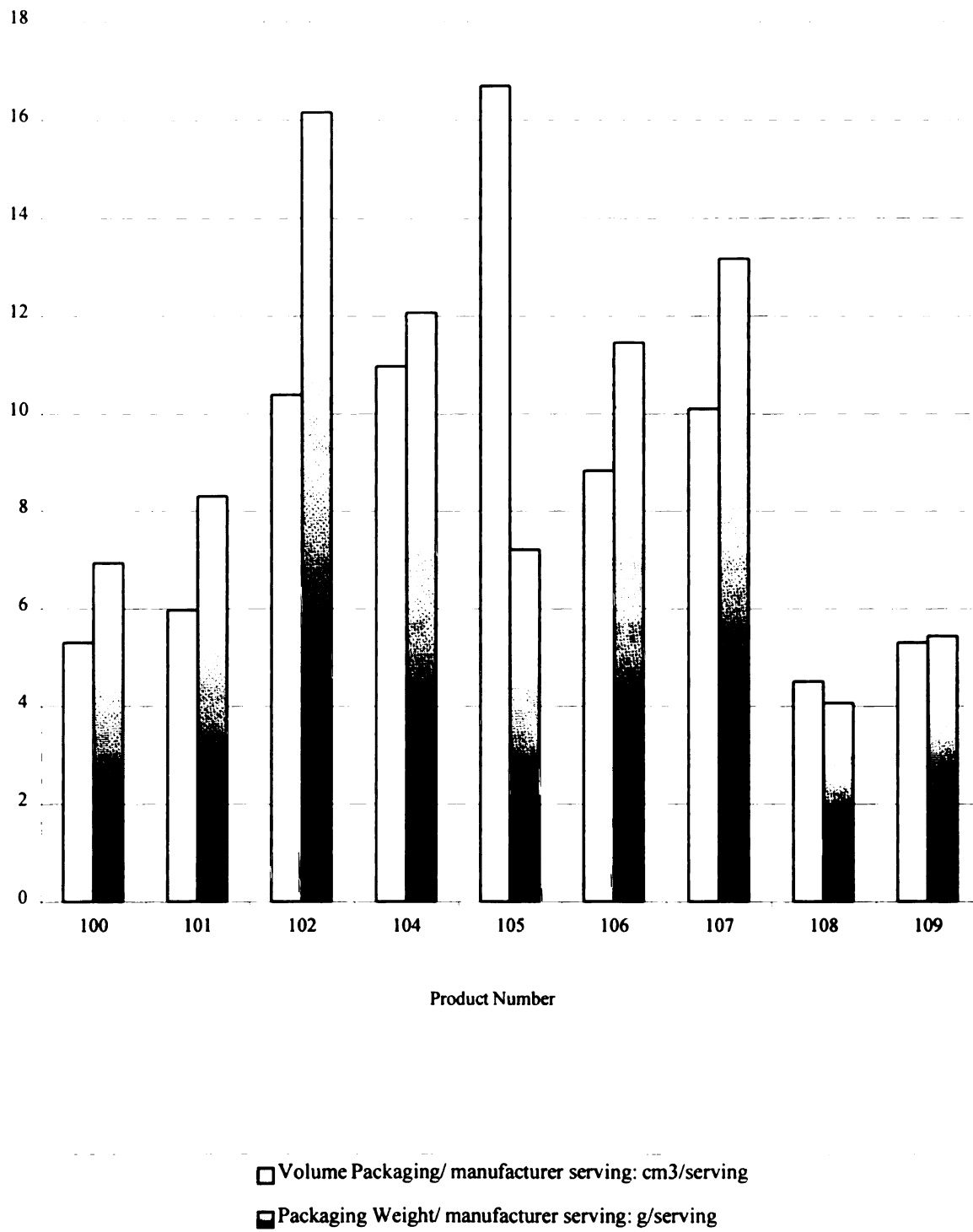


Figure 5.41 Water Comparative Data

YOGURT:

The yogurt product group consisted of five product/package systems. The products selected for this group were plain and strawberry yogurts.

Table 5.45 Yogurt Comparative Data

Product Number	Volume Packaging/ Manufacturer serving cm3/serving	Volume Packaging/ Standard Use cm3/use	Volume Packaging/ Product Weight cm3/g	Packaging Weight/ Product Weight g/g	Packaging Weight/ Manufacturer serving g/serving	Packaging Weight/ Standard Use g/use
211	10.281	10.169	0.045	0.040	9.195	9.095
212	14.331	13.727	0.060	0.056	13.220	12.662
213	5.524	9.073	0.044	0.042	5.390	8.853
253	14.274	15.147	0.080	0.081	14.459	15.344
254	10.625	11.534	0.092	0.089	10.349	11.234

Product 213 used the least packaging material in this product group. The packaging for this product consisted of 6 polypropylene plastic cups with a plastic/foil laminate seal. Product 253 used the most packaging material in this product group on a packaging weight per standard use basis. The packaging for this product consisted of a single polystyrene (PS) tray with a plastic/foil laminate seal.

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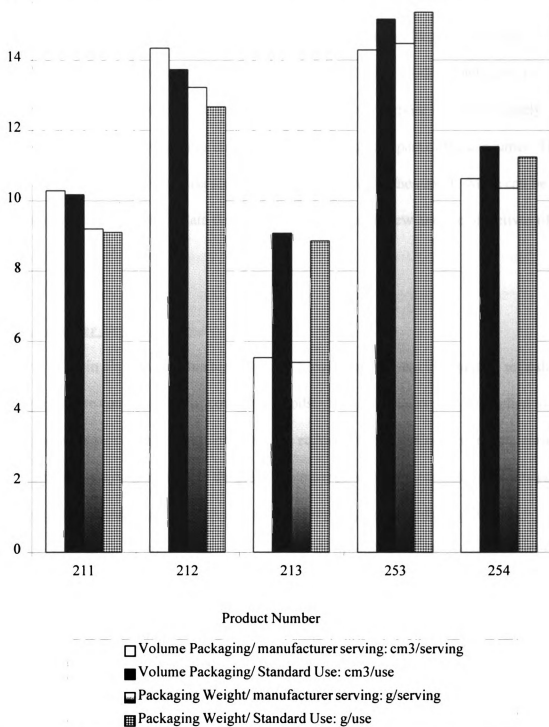


Figure 5.42 Yogurt Comparative Data

5.3 Application of the Results:

The information presented in this report is a basis for dozens of conclusions. Each reading of the report leads to new, or enhanced, conclusions. Close reading, thinking, and interpretation of the data lead the mind into new channels. To obtain full value from the report, one must invest some time and thought in deeper conceptual analysis than is usually used for this kind of comparative data. Modern packaging is complex, and usually designed for a specific purpose. That purpose is usually closely associated with product properties and life style choices on the part of the consumer. The interpretations that follow discuss some general findings from the report. More can be found through analysis of the data depending on the point of view and the objectives of the reader.

5.3.1 Consumer Uses of Data:

The main objective of this report was to provide consumers information regarding packaging waste comparisons for consumer goods. This information can be applied to help consumers purchase products on a “source reduction” basis. Consumers can learn which packaging systems produce the least waste per product amount and which systems produce the most waste per product amount. The report provides consumers with specific information on 40 product categories, but the trends found can be applied over the entire gamut of consumer products. The main method for consumers to apply this information in their daily lives is to purchase products with this information in mind. This may require a change in purchasing habits for some consumers. The consumer must be willing to purchase product, not on a brand name basis, but on a packaging system

basis. The following data interpretations will aid consumers in understanding the trends found in this study.

5.3.2 Data Interpretation:

The most efficient packages tended to use single components while the least efficient packages often used multiple components. An example of this was found in the baking mix category. The muffin mix with the least packaging, 1.2 g package for 100 g of product, was in a plastic pouch. The muffin mix with the most packaging, 14.3 g package for 100 g of product, used a plastic pouch and a metal can inside a paperboard carton.

The most efficient packages tended to use flexible materials, while the least efficient packages tended to use rigid packaging systems. An example of this can be seen in the poultry category. Chicken in a low-density polyethylene bag resulted in 0.3 g package for 100 g of product, while chicken in a polystyrene tray with a plastic label and plastic outer wrap resulted in 1.7 g package for 100 g of product.

The most efficient packages tended to contain larger quantities of product, while the least efficient packages tended to contain single servings. An example of this can be seen in the hand dish soap category. Soap in a 42.7 fl. oz HDPE bottle produced 4.7 g package for 100 g of product, while soap in a 14.7 fl. oz PET bottle produced 6.9 g package for 100 g of product. This relationship only holds true if the entire amount of product from the larger sized item is used. If the product in the larger size is not used and goes bad, both additional product and additional packaging reach the waste stream.

Convenience for the consumer often results in increased packaging. An example of this can be seen in the toothpaste category. The most efficient tube resulted in 9.9 g product for 100 g of toothpaste, while toothpaste in a dispensing pump (and a paperboard box) resulted in 127 g package for 100 g of product. The convenience of the pump system results in more packaging material being produced when the pump is empty. This impact of the pump system can be lessened somewhat if refills for the system are used, thereby removing the pump base from the waste stream.

Thinking outside the usual forms of products can result in equivalent product with less packaging waste. An example of this can be seen in the vegetable category. Fresh carrots in a plastic bag resulted in only 0.4 g package for 100 g of product, while canned carrots resulted in 12.7 g package for 100 g of product. The product delivered to the consumer is the same, carrot in this case, but the form of the product is different. The canned carrots have been processed, while the fresh carrots appear in their whole, unprocessed form. The consumer may produce additional wastes, such as peels and stems, if whole carrots are purchased. This example illustrates that only packaging, and not other wastes (such as carrot peels) were included in this study. However, it can be noted that frozen carrots in a plastic bag resulted in only 1.0-g package for 100 g of product.

5.4 Volume and Weight Comparison Discussion:

This study compared packaging systems on two separate bases, the packaging weight and the packaging volume. These comparisons were typically in agreement when looking at the packaging systems that produced the least and most packaging waste after

use. In this study, the selection of the product/packaging system that produced the least waste was the packaging system that had the lower weight comparison values. This was done because the weight comparison was more accurate, since a direct measure of the packaging system was available. The volume as defined in this study is the space occupied by the packaging material itself, not the amount of space within the package. This is more difficult to determine accurately than the package weight. This was due in part to the additional measurements required to determine the volume of the packaging materials. When the volume has been determined, the amount of compressibility of the package in a landfill is not known, so the effect on the volume is not known with any precision. For example, a plastic wrap will compress to a very small volume, not much more than its own intrinsic volume. A plastic bottle will be much less compressible because of its shape, thickness and stiffness. The void volume of the bottle in a landfill may be a much higher ratio than the void volume for a plastic wrap. The volume comparisons in this study were therefore based upon the packaging system having an insignificant void volume in a landfill setting.

The packaging system selected as producing the least and most packaging material after use was typically in agreement, as stated above. For some categories, this did not hold true. In these instances, the packaging system that produced the lowest comparative values on a packaging weight basis would not produce the lowest values on the volume basis. One reason for this occurrence is the inability to measure the compressibility of the packaging system. An example of this can be seen in the egg category. The package that produced the least packaging material overall was an expanded polystyrene foam container (EPS). This packaging system had the lowest

comparative values in the packaging weight comparisons, thereby making it the choice for lowest packaging material amounts. However, this packaging system was not the best in the volume-based comparisons. This system produced higher comparative values for the volume comparison than in another system consisting of a pulpboard package. The difference in the volume based comparative values for the two packaging systems was directly related to the compressibility of the two systems. The EPS system consists of an expanded foam material, which has a large amount of void volume within the foam structure. This void volume was not compressed during analysis thereby resulting in the larger volume comparative values for this system. As stated before, the volume measurements were not as accurate as the weight measurements due in part to the inability to compress the package to a set level, or a level normally seen in a landfill. It was not possible to compress the EPS system to a real-life landfill level, since no data on this level exists and since the amount would vary significantly from landfill to landfill.

5.5 Manufacturer Serving Size and Standard Use Discussion:

Foods, and some other products as well, carry a manufacturer's recommendation for the amount that constitutes a “use” or serving. These use amounts are the basis for the nutritional information located on food packages. The caloric content and the nutritional value are all based on one “use” or serving of a particular food product. These use amounts also allow the manufacturer to set a serving per container value for food items. The Food and Drug Administration and the U. S. Department of Agriculture have developed a great deal of tabulated data on the “serving size” for many foods. The size and nutritional value of a “serving” as determined by an individual manufacturer can

vary significantly, even within a single category. An example of this can be seen in the cereal category. One manufacturer defined a “serving” as 150 calories for regular oatmeal, but only 100 calories for instant oatmeal. A different manufacturer defined a serving as 140 calories. Size of serving cannot be used any more reliably, especially when comparisons must be made between products with different characteristics. A serving of puffed rice is a different size than a serving of cornflakes, for example.

Choosing an appropriate basis of comparison can be difficult. As illustrated above, the meaning of a “serving” can be very different from manufacturer to manufacturer. Comparisons based on manufacturer serving size can vary significantly within the same product category if manufacturer serving levels are different. The standard use basis, used in this study, rectifies this situation by making all serving amounts equal among products within a product category.

The standard use for this study was based upon a 100 calorie per use basis for a majority of the products in this study. This amount provided ease in calculating the standard use serving amount for each product. This level can be changed, so long as it is changed for every product comparison in the study.

For some products, the standard use comparison determined differently. The products where this occurred were typically household items, such as hand soap and toothpaste. The standard use amount for these products was set at normal use levels for these products. This means that standard use amounts were set at the “standard amount of product” typically used for these items by an individual. The levels were set through an ad-hoc study among the thesis committee members. While this was not done by any designed experiment with proven validity over all consumers, it was done in an unbiased

manner, and the same standard was used in all applications, so the comparison of packaging material per use within a product category is based on a constant value. This value can be changed so long as it is changed for every product in a given product category. The product groups that had standard use levels set in this manner are described in the following section.

5.5.1 Product Groups of Varied Standard Use Levels:

Nine product groups required different standard use quantities to be set for comparative purposes in the study. The categories for which this was done are as follows: cleaners, dish soap, hand soap, laundry detergent, paper towels, shampoo, tissue, toilet tissue, and toothpaste.

The cleaner group was made up of powder and liquid products. The standard use amount was determined through typical use levels for both forms of these products, determined to be $\frac{1}{4}$ cup of product. The amount of liquid product required to fill $\frac{1}{4}$ cup was determined to be 59 milliliters. The amount of powdered product required to fill $\frac{1}{4}$ cup was determined to be 30 grams. These product amounts were used for the standard use comparison level of $\frac{1}{4}$ cup for this product group.

The dish soap category consisted of 2 different product types, hand dish soap, and automatic dish soap. The category was split into these two sub-categories for comparison purposes, since hand dish soaps cannot be used in automatic dishwashers. The standard use comparisons were based upon a one wash basis, which was determined to be 15 ml for hand soaps and 56 g for automatic dish soaps. The automatic dish soaps came in two product forms, powdered and liquid. The manufacturer of these products measures the

liquid form of these products in grams, not milliliters. This practice was continued in this study and therefore the standard use level of 56 grams was used for both product forms.

The hand soap product group consisted of 9 product/package systems including bar soaps and liquid soaps. The standard use amount was based upon actual hand washings of the ad hoc study. This “study” consisted of a series of hand washings, from which the average soap per use was calculated for each product type (liquid or bar). This analysis determined that bar soap was used at 2.1 gram per washing, and liquid soap was used at 5 milliliters per washing.

The laundry detergent product group consisted of 7 product/package systems. This product category consisted of two product types, liquid detergents and solid detergents. The standard use levels were determined through actual measurements of laundry detergent used to do one wash load. A regular sized wash load was selected for analysis in the study. The standard use amount for powdered detergent was 62 grams per use, and for liquid detergent was 121 milliliters per use.

The shampoo category consisted of 4 product/packaging systems. Standard use comparisons for this product category were based upon the amount of shampoo used for one wash, determined to be 10 milliliters.

The toothpaste product category consisted of 6 product/package systems. The standard use comparison was based upon the amount of toothpaste used for one brushing. This amount was determined to be 1.572 grams.

The paper product groups that were analyzed in this study had standard use amounts based upon an amount of product typically used for one use. The paper towel standard use comparison was based upon one 11”x11” paper towel per use. The tissue

standard use comparison was based upon 1 sq. ft. of tissue per use. The toilet tissue product category standard use comparison was based upon 1 sq. ft. of tissue per use.

These standard use levels can be changed to any desired amount so long as the amount is applied to every product in the particular product category.

Chapter 6

Summary and Suggestions for Future Research

This chapter will present the summary of the study, including a review of the objectives and major trends found in the study. The chapter concludes with a discussion of future research suggestions.

6.1 Summary:

Source reduction is a practice that can have a significant impact on waste reduction. This is the process in which the amount of waste generated is reduced at the designing, manufacturing, packaging and purchasing phase of a product. Consumers can apply source reduction practices during the selection/purchasing phase of consumer goods. This study provides consumers with information regarding consumer packaging on a source reduction per amount of product basis.

The purpose of this study was to conduct a comprehensive analysis of reduced packaging for common consumer items found in supermarkets. The analysis was done to provide information about the amount of waste that a packaging system provides after product use. This will act as a guide to the types of grocery item packaging systems that will provide the consumer with the least material to dispose of after product use.

The approach was to select an array of supermarket product categories representative of consumer purchases; to identify within the categories specific products that are offered in a variety of sizes, modes of preparation, and types of packaging. The study consisted of 40 categories of products, represented by 252 individual products.

Within each product category, a range of products was selected that represented the variety of packaging options available in the supermarket. The objective was to include all combinations of packaging that might result from purchases of product based on life style choices not necessarily related to minimizing packaging solid waste. Thus, the consumer can know the packaging solid waste impact of most of the purchase choices available.

The amount of packaging for each product was determined. This was, in fact, a determination of the amount of solid waste resulting from each package type, each kind of material, or combination of package type and material. The amount of packaging was determined on both a weight basis, and a volume basis. The weight basis is the easier of the two to determine, and is the easier one for most people to visualize. The volume basis refers to the volume of the solid packaging material that surrounds the product.

Once the weight and volume of the packaging components were determined, the calculated weight and volume of packaging material used per unit amount of product was determined. This calculation was made on three different bases: 1) per gram of product for solids or per milliliter of product for liquids, 2) per manufacturer's recommended use, and 3) per standard use. The standard use calculation involves a level of "use" that is equivalent for all products in a particular product group. These comparisons were then used to determine the packaging systems that provided the most and the least material per delivered unit of product after product use for each product category.

The products were then grouped into two hypothetical "market baskets". Market basket 1 is the group of products using the least packaging per amount of product, and market basket 2 is the group of products using the most packaging per amount of product.

The volume of packaging material per standard use in market basket 2 was 7.5 times the volume in market basket 1. The packaging weight per standard use in market basket 2 was 15.2 times the weight in market basket 1. The volume of packaging per gram of product and the packaging weight per gram of product were 4.1 and 5.7 times, respectively, as large in market basket 2 as in market basket 1. The comparisons based on the number of uses or servings are the most relevant in educating consumers to make choices that reduce generation of packaging waste.

6.2 Conclusions:

The main objective of this report was to provide consumers information regarding packaging waste comparisons for consumer goods. This information can be applied to help consumers purchase products on a “source reduction” basis. Consumers can learn which packaging systems produce the least waste per product amount and which systems produce the most waste per product amount. The report provides consumers with specific information on 40 product categories, but the trends found can be applied over the entire gamut of consumer products. The main method for consumers to apply this information in their daily lives is to purchase products with this information in mind. This may require a change in purchasing habits for some consumers. The consumer must be willing to purchase product, not on a brand name basis, but on a packaging system basis. The following data interpretations will aid consumers in understanding the trends found in this study.

A consumer purchasing a “market basket” containing one standard unit of each product and choosing the items with the most packaging would end up with more than

five times the weight of packaging as a consumer choosing the “market basket” of items with the least packaging.

Consumer life style choices play a large role in the amount of packaging that accompanies a product. A consumer choice to use prepared meals rather than preparing fresh food has an impact on the amount of packaging used. Usually this choice leads to more packaging because of the more complex requirements for preservation of the prepared food. A consumer choice to buy in small quantity rather than large quantity has an impact on the amount of packaging used. Usually this choice leads to more packaging, but more packaging may be cheaper and more environmentally friendly than discarded product.

The most efficient packages tended to use single components, such as a flexible plastic pouch. The least efficient packages tended to consist of multiple components.

The most efficient packages tended to consist of flexible material, whereas the least efficient packages tended to use rigid materials. Rigid materials include components such as corrugated boxes and glass bottles.

The packaging systems that most often appeared in market basket 1 include paper/plastic/foil laminate pouches, single low-density polyethylene (LDPE) bags, polyethylene terephthalate (PET) bottles, and plastic pouches. Market basket 2 was primarily composed of packages that used multiple components in the packaging system. These systems include paperboard cartons with internal plastic sealed bags, amber and clear glass jars with paper labels, expanded polystyrene trays (EPS) with plastic wrap, and corrugated boxes with plastic/foil pouches inside.

The most efficient packages tended to contain larger quantities of product, while the least efficient packages tended to contain smaller quantities. This effect only holds true if all product from the larger sized package is used. If product is wasted, such as spoilage, both additional product and additional packaging are reaching the waste stream.

The decisions a consumer makes when purchasing grocery items can have a significant impact on the amount of packaging material that they discard. By applying the information found in this study, consumers can decrease their output of packaging wastes on a per amount of product basis. Consumers can also influence product manufacturers' choice of packaging systems by "voting" with their purchasing power. This can lead to continued innovations of packaging systems on the manufacturers' part to reduce waste amounts on a per amount of product basis.

6.3 Limitations of the Study:

This study examined only retail packaging. In some cases, less primary packaging for the consumer to take home involves the use of more secondary packaging for safe distribution of the product. No attempt was made to examine the effects of retail packaging on distribution packaging.

The study focused on the weight and volume of packaging. The amount of disposed waste generated by a purchasing decision is influenced also by the amount of the packaging which can be diverted to recycling, or which can be reused. These factors were not considered in determining the most and least efficient packages. In addition to waste, there are a number of other important environmental impacts of packaging, such as resource use, including energy; and environmental emissions, including air and water pollutants. These were not addressed in any systematic fashion. Further, minimal packaging is successful only to the extent that it delivers product in an acceptable condition to the consumer. The amount and type of packaging has an effect on the shelf life of the product (the length of time it remains salable) and thus affects the amount of the product, with its associated packaging, that reaches the waste stream.

6.4 Suggestions for Future Research:

The results of this study were based upon comparisons of packaging material per amount of product basis. These results were focused toward consumers, and the packaging that consumers take home. This means that only the primary packaging materials were analyzed. The study did not include the secondary (distribution) packaging in which the primary packages were delivered. Inclusion of these in the study

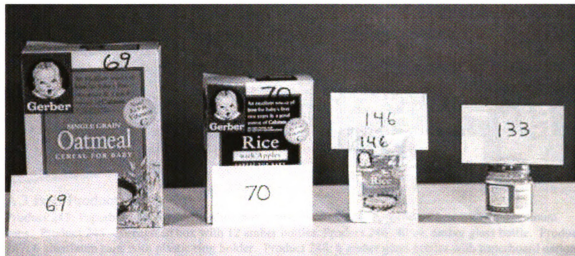
would provide a broader look at all the packaging materials used in delivering a consumer product to the consumer's home. This would provide an opportunity to evaluate each product/package system as a whole. The inclusion of the secondary materials would level the playing field further for each system within a product group. Some primary packaging systems may be "light weighted" in order to save on primary packaging materials. This would require a strong secondary packaging component to protect the product from damage during transit. In this study, items like this may produce good results, but in essence may produce more waste due to the requirement of a larger secondary packaging system.

This study was focussed on a single environmental area, source reduction. The study was designed to compare consumer packaging for source reduction purposes. Other environmental effects such as recycling, composting, air emissions and water emissions were not included. The inclusion of these areas in the study would provide a larger overall picture of the waste effect of consumer packaging. This would allow for evaluation of the consumer packaging systems on more of a true life-cycle assessment scale. This, however, would be difficult to do since each component in a given packaging system would need to have each environmental impact quantified. Some of the environmental components, such as recycling and composting, would have readily available information regarding the given packaging components. The difficulty arises in quantifying impacts, such as emissions and waste water effluents. Future studies in this area should pursue inclusion of more environmental factors, although not all areas may be feasible to quantify.

The data obtained from this study can also be used in future works for comparative purposes. The raw data collected can be used to compare packaging systems on a variety of other bases. This will allow for future researchers to compare product/package systems on different scales other than a per amount of product basis. The study can also be used as a guideline for concept application to other areas of packaging. Studies could be done in a variety of areas other than consumer goods. These could include distribution packaging and institutional packaging to name a few.

Appendix A

Pictures of Product Groups



A.1 Baby Food Product Group

Product 69: paperboard box with outer plastic wrapping. Product 70: paperboard box with outer plastic wrapping. Product 133: clear glass jar with a metal recloseable lid. Product 146: Paper/foil/plastic laminate pouch.



A.2 Baking Mix Product Group

Product 40: Plastic pillow pouch. Product 41: Paperboard box with paper/plastic laminate bag. Product 42: Paperboard box, plastic pillow pouch, steel 2-piece steel can. Product 43: Paper bag. Product 44: Paper/plastic laminate bag.



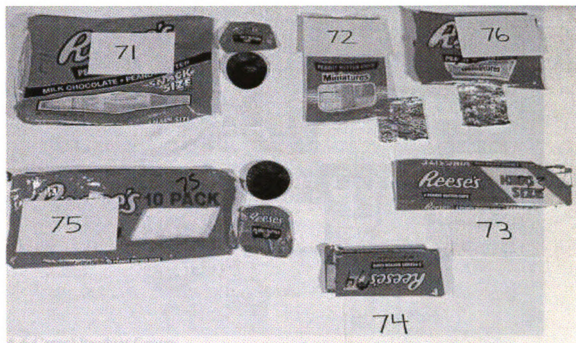
A.3 Beer Product Group

Product 243: Paperboard box with 12 aluminum cans. Product 244: Paperboard box with 24 aluminum cans. Product 245: Corrugated box with 12 amber bottles. Product 246: 40 oz. amber glass bottle. Product 247: 6 aluminum cans with plastic ring holder. Product 248: 6 amber glass bottles with paperboard carton.



A.4 Bread Product Group

Product 77: LDPE plastic bag. Product 78: LDPE plastic bag, inner plastic wrap. Product 79: LDPE plastic bag, inner plastic wrap.



A.5 Candy Product Group

Product 71: LDPE plastic bag, plastic candy wrapper, paperboard backing, paper cup. Product 72: Plastic

outer bag, foil candy wrap, paper cup. Product 73: Plastic outer wrap, paperboard tray, paper cup.

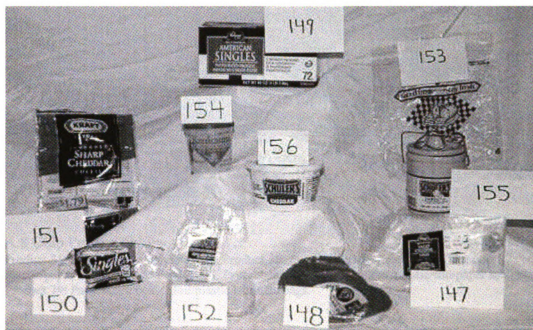
Product 74: Plastic outer wrap, paperboard tray, paper cup. Product 75: Plastic outer wrap, paperboard

tray, plastic candy wrap, paper cups. Product 76: Plastic outer bag, foil candy wrapper, paper cup.



A.6 Cereal Product Group

Product 1: Paperboard tube, plastic top. Product 2: Paperboard tube, plastic top. Product 3: Paperboard box, 12 paper/plastic laminate pouches. Product 4: Paperboard box, inner plastic cereal pouch. Product 5: Paperboard box, inner plastic cereal pouch. Product 6: LDPE plastic bag. Product 7: Outer plastic wrap, 8 paperboard boxes, 8 inner plastic cereal pouches. Product 25: Paperboard tube, plastic top. Product 26: Paperboard tube, plastic top.



A.7 Cheese Product Group

Product 147: Plastic pillow pouch (vacuum-sealed). Product 148: Wax outer coating, inner plastic wrap.
 Product 149: Paperboard carton, 4 plastic sealed cheese wraps, individual plastic cheese wraps. Product 150: Plastic outer wrap, individual plastic cheese wraps. Product 151: Plastic recloseable bag.
 Product 152: Plastic pillow pouch, paperboard backing. Product 153: LDPE plastic recloseable bag.
 Product 154: HDPE plastic tub with HDPE lid. Product 155: Ceramic jar, inner plastic sealed tube, metal closure. Product 156: Plastic tub, plastic lid.



A.8 Chip Product Group

Product 35: Plastic/paper laminate bag. Product 36: Plastic/paper laminate pouch. Product 37: Plastic/paper laminate bag. Product 38: Paperboard tube, metal bottom, plastic/foil/paper seal, plastic lid. Product 39: Paperboard box, 2 foil/plastic laminate bags.



A.9 Cleaner Product Group

Product 173: HDPE plastic bottle. Product 175: HDPE plastic bottle. Product 249: PET plastic bottle. Product 250: Paperboard laminated box.



A.10 Cookie Product Group

Product 17: Paper/foil/plastic laminate bag, paperboard tray. Product 18: Paper/plastic bag, 2 paper cups. Product 19: Paperboard carton, plastic wrap. Product 20: Paperboard box, plastic/foil inner bag. Product 21: EPS tray, plastic wrapping.



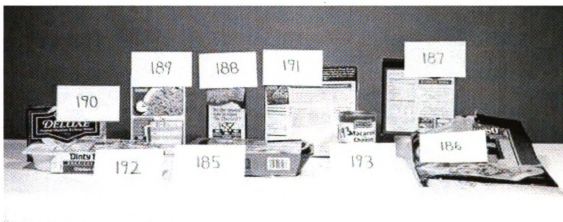
A.11 Cookie Product Group

Product 22: Plastic outer wrap, PS tray. Product 23: Plastic/foil laminate pouch. Product 24: Plastic/foil laminate pouch, paperboard tray. Product 27: Paperboard box, plastic/foil laminate bag, PS tray. Product 28: Paperboard box, 4 plastic sealed wrappers. Product 29: PS carton.



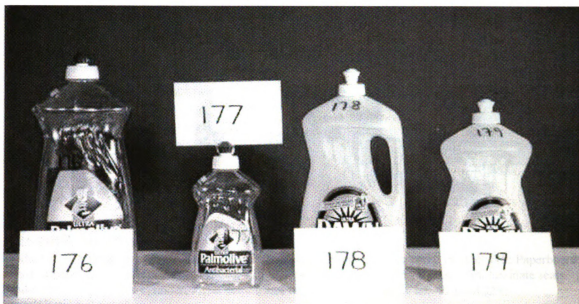
A.12 Cracker Product Group

Product 30: Paperboard box, 3 plastic sealed bags. Product 31: Paperboard carton, 4 plastic sealed bags. Product 32: Paperboard box, 4 plastic sealed bags. Product 33: Paper/plastic laminate bag. Product 34: Plastic fin vertical back sealed pouch.



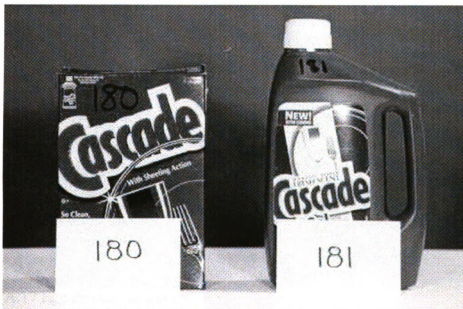
A.13 Dinners Product Group

Product 185: Paperboard carton, EPS tray, Paper/plastic laminate tray, plastic/foil laminate pouch, plastic pouch, outer plastic wrapping. Product 186: Plastic sealed outer pouch, top and bottom seal with fin vertical seal, plastic pouch for sauce, plastic mesh pouch. Product 187: Paperboard box, plastic/foil laminate pouch. Product 188: Paperboard carton, paper/plastic/foil laminate pouch. Product 189: Paperboard box, paper/plastic/foil laminate pouch. Product 190: Paperboard box, plastic/foil laminate pouch. Product 191: Paperboard carton, PET plastic plate, Plastic film plate covering. Product 192: Paperboard carton, plastic tray, plastic film cover. Product 193: Three-piece steel can, paper label.



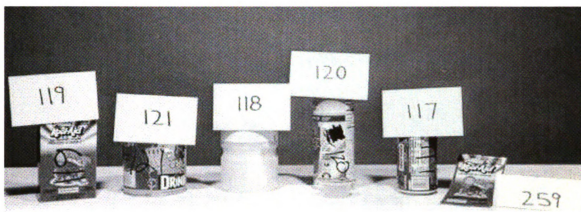
A.14 Hand Dish Soap Product Category

Product 176: PET plastic bottle (42 fl.oz). Product 177: PET plastic bottle (14.7 fl.oz.).
Product 178: HDPE plastic bottle (42.7 fl.oz). Product 179: HDPE plastic bottle (28 fl.oz.)



A.15 Auto Dish Detergent Product Group

Product 180: Paperboard box with paper/foil laminate outer label. Product 181: HDPE plastic bottle.



A.16 Drink Mix Product Group

Product 117: Aluminum can. Product 118: HDPE plastic container, plastic label. Product 119: Paperboard carton, 4 paper/plastic/foil pouches. Product 120: Plastic tube, 6 plastic tubs, 6 plastic/foil laminate seals. Product 121: Paperboard cylinder, metal bottom and top, plastic recloseable lid. Product 259: Paper/plastic/foil pouch.



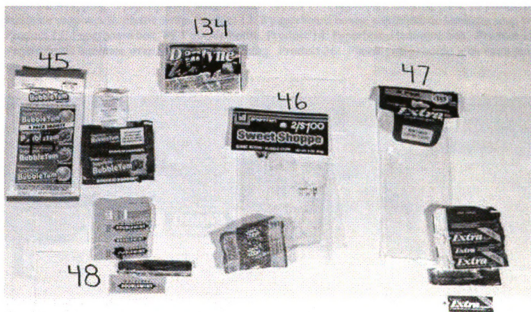
A.17 Egg Product Group

Product 171: EPS foam container. Product 172: Pulpboard container. Product 174: Pulpboard container, plastic wrap. Product 258: EPS foam container, plastic wrap.



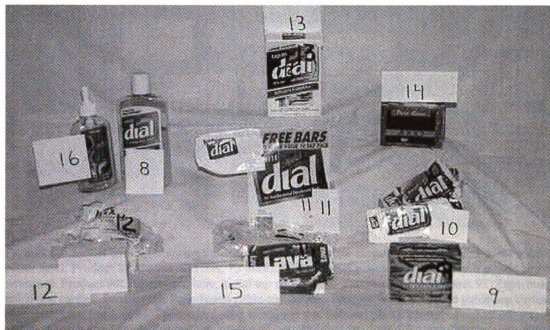
A.18 Fruit Product Group

Product 214: Plastic mesh bag, plastic label. Product 215: Clear glass jar, metal lug closure. Product 216: 3-piece steel can, paper label. Product 217: 3-piece steel can, paper label. Product 218: Paperboard carton, 4 three-piece aluminum cans, 4 paper labels. Product 221: HDPE plastic bag.



A.19 Gum Product Group

Product 45: Plastic outer bag, 4 plastic/foil laminate gum wrappers, 20 paper/plastic laminate gum wrappers. Product 46: Plastic bag, paper adhesive label, 17 paper/plastic gum wrappers. Product 47: Plastic outer bag, adhesive paper label, 8 plastic/foil laminate gum wrappers, 40 paper wrappers, 40 foil wrappers. Product 48: Plastic/foil laminate gum wrapper, 5 paper wrappers, 5 foil wrappers. Product 134: Paperboard carton, plastic blister pack, foil/plastic laminate seal.



A.20 Hand Soap Product Group

Product 8: PET plastic bottle. Product 9: Paperboard box, 2 plastic soap wraps. Product 10: Plastic/foil laminate wrapping, 3 paper/plastic soap wraps. Product 11: Paperboard backing card, 10 plastic/paper laminate soap wraps, plastic wrap. Product 12: 2 paperboard boxes, paper/plastic laminate soap wraps. Product 13: Paperboard box, PET plastic bottle. Product 14: Paperboard laminate box. Product 15: Paper/plastic laminate wrap, paperboard backing. Product 16: Plastic (PET) bottle with hand pump.



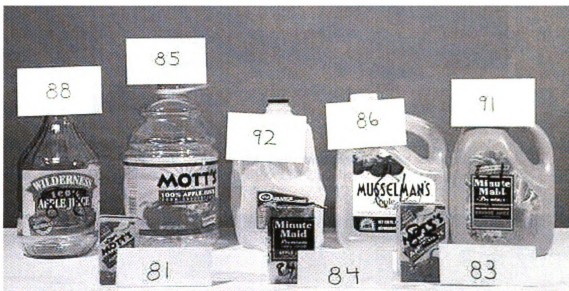
A.21 Ice Cream Product Group

Product 236: HDPE plastic tub, plastic lid. Product 237: Laminated paperboard carton. Product 238: Paperboard tub, plastic lid. Product 239: Paperboard tub, paperboard lid. Product 240: Paperboard tub, paper/plastic laminate lid.



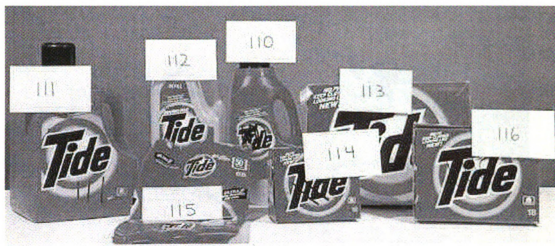
A.22 Juice Product Group

Product 80: 6 steel cans, plastic ring holder, plastic/foil laminate closures. Product 82: 3-piece steel can, paper label. Product 89: Corrugated box, 10 plastic/foil laminate pouches, 10 straws and plastic straw wrappers. Product 90: Paperboard tube, metal top and bottom, plastic closure. Product 93: Paperboard gable-top carton. Product 94: Paperboard gable-top carton. Product 96: Paperboard gable-top carton, plastic closure. Product 97: Paperboard tube, metal top and bottom, plastic closure. Product 98: Paperboard carton, 3 gable-top paperboard cartons, plastic straws. Product 99: 6 HDPE plastic bottles with plastic closures, plastic outer wrapping, paperboard backer material, plastic labels.



A.23 Juice Product Group

Product 81: 4 paperboard laminate drink boxes, plastic outer wrap. Product 83: 3 paperboard laminate drink boxes, outer plastic wrapping. Product 84: 9 paperboard laminate drink boxes, plastic outer wrap. Product 85: PET plastic bottle with HDPE cap. Product 86: HDPE plastic bottle. Product 88: Clear glass bottle, paper label. Product 91: HDPE plastic bottle. Product 92: HDPE gallon jug.



A.24 Laundry Detergent Product Group

Product 110: HDPE plastic bottle. Product 111: HDPE plastic bottle. Product 112: HDPE plastic bottle. Product 113: Paperboard box. Product 114: Paperboard box. Product 115: LDPE plastic bag. Product 116: Paperboard box.



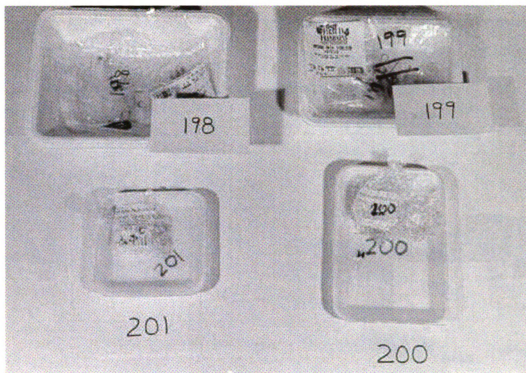
A.25 Lunch Meat Product Group

Product 157: LDPE plastic pouch. Product 158: Paperboard carton, 4-sided sealed plastic pouch. Product 159: Plastic recloseable bag. Product 160: LDPE plastic recloseable bag, plastic inner wrap.



A.26 Margarine Product Group

Product 167: Paperboard carton, 2 Polypropylene plastic cups and lids. Product 168: Paperboard carton, 4 foil wrappers. Product 169: HDPE plastic bottle. Product 170: HDPE plastic tub with lid. Product 257: Paperboard carton, 4 paper wrappers.



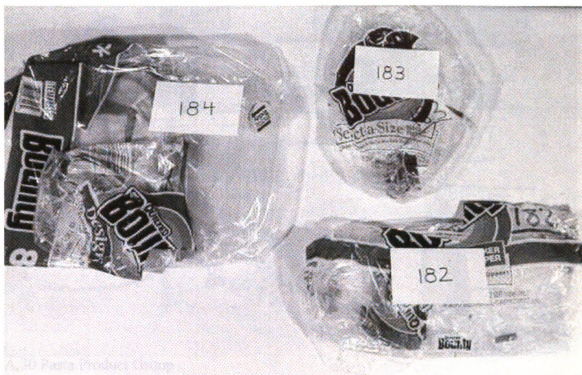
A.27 Meat Product Group

Product 198: EPS foam tray, plastic wrap material, laminated plastic film on EPS foam. Product 199: EPS foam tray, plastic wrap material, laminated plastic film on EPS foam. Product 200: EPS foam tray, plastic wrap material, laminated plastic film on EPS foam. Product 201: EPS foam tray, plastic wrapping.



A.28 Milk Product Group

Product 161: HDPE half-gallon jug. Product 162: HDPE plastic gallon jug. Product 163: Paperboard gable-top carton. Product 164: Paperboard gable-top carton. Product 165: Paperboard gable-top carton. Product 166: PET plastic bottle. Product 251: HDPE plastic pigmented bottle, plastic label. Product 252: 6 HDPE plastic pigmented bottles, 6 plastic labels, plastic wrapping. Product 260: LDPE plastic bag.



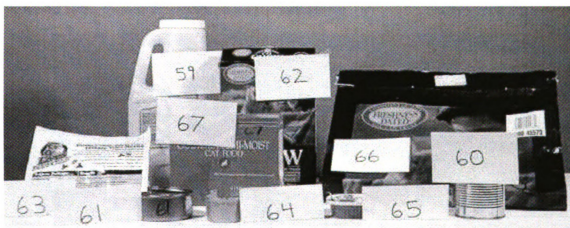
A.29 Paper Towel Product Group

Product 182: LDPE plastic outer wrapping. Product 183: LDPE plastic roll wrapping. Product 184: LDPE plastic outer wrapping, 8 LDPE plastic roll wrappings.



A.30 Pasta Product Group

Product 50: Paperboard box. Product 51: Plastic bag. Product 52: Paperboard carton. Product 53: Plastic pouch. Product 54: Plastic tray, plastic film cover. Product 55: Paper/plastic laminate bag. Product 56: Plastic pouch. Product 57: EPS foam tray, plastic wrap. Product 58: Plastic bag, adhesive paper closure.



A.31 Pet Food Product Group

Product 59: HDPE plastic container. Product 60: 3-piece steel can, paper label. Product 61: 2-piece steel can, paper label. Product 62: Paperboard box. Product 63: Paper/plastic laminate bag. Product 64: 2-piece metal can, paper label. Product 65: Plastic tray, plastic/foil laminate seal. Product 66: Multi-wall paper bag. Product 67: Paperboard box, 6 plastic pouches.



A.32 Poultry Product Group

Product 202: LDPE plastic bag. Product 203: EPS foam tray, plastic label, plastic wrapping.



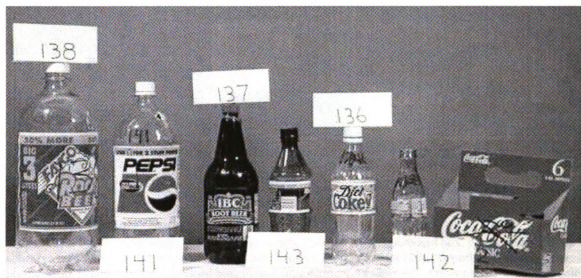
A.33 Shampoo Product Group

Product 232: HDPE plastic pigmented bottle. Product 233: PET plastic bottle. Product 234: HDPE plastic pigmented bottle. Product 235: HDPE plastic pigmented bottle.



A.34 Soft Drink Product Group

Product 135: Paperboard carton, 24 aluminum cans. Product 139: 6 aluminum cans, plastic ring holder. Product 140: LDPE plastic outer wrapping, 12 aluminum cans. Product 144: Paperboard carton, 12 aluminum cans.



A.35 Soft Drink Product Group

Product 136: 6 PET plastic bottles, plastic ring holder. Product 137: Amber glass bottle. Product 138: PET plastic bottle (3-liter). Product 141: PET plastic bottle (2-liter). Product 142: Paperboard carton, 6 clear glass bottles. Product 143: PET plastic bottle.



A.36 Soup Product Group

Product 204: Paperboard carton, 4 paper/plastic/foil laminate pouches. Product 205: Paper/plastic/foil laminate pouch. Product 206: Paperboard cup, paper/plastic laminate seal. Product 207: Paperboard carton, 2 HDPE plastic trays, plastic film. Product 208: 2-piece steel can, paper label. Product 209: 3-piece steel can, paper label. Product 210: Clear glass jar, metal lug cap.



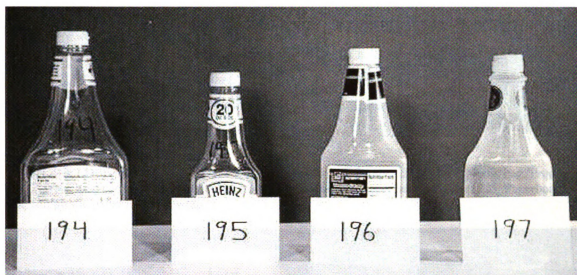
A.37 Tissue Product Group

Product 122: Plastic outer wrap, 8 plastic tissue wraps. Product 123: Paperboard box, plastic wrap, plastic adhesive card. Product 124: Paperboard box, plastic outer wrap. Product 125: 3 paperboard boxes, outer plastic wrap. Product 126: Paperboard box, plastic film window. Product 127: Outer plastic wrap, 6 plastic pouches.



A.38 Toilet Tissue Product Group

Product 128: Outer plastic wrap. Product 129: Outer plastic wrap. Product 130: Paper outer wrap.



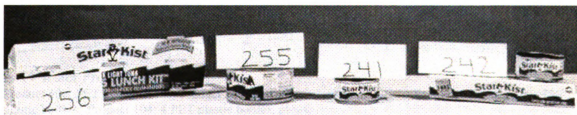
A.39 Tomato Product Group

Product 194: PET plastic bottle. Product 195: PET plastic bottle. Product 196: Plastic laminate bottle. Product 197: Plastic laminate bottle.



A.40 Toothpaste Product Group

Product 226: Paperboard carton, plastic/foil laminate tube. Product 227: Paperboard carton, Plastic tube. Product 228: Paperboard carton, plastic/foil laminate tube. Product 229: Plastic self-standing laminate tube. Product 230: Plastic molded container, inner plastic/foil laminate pouch. Product 231: Paperboard carton, plastic molded pump container.



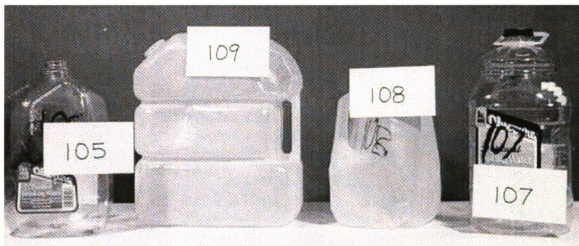
A.41 Tuna Fish Product Group

Product 241: 2-piece can, paper label. Product 242: Paperboard carton, 3 2-piece steel cans, 3 paper labels. Product 255: 2-piece steel can, paper label. Product 256: Paperboard carton, 3 PET plastic containers, 3 2-piece steel cans, 3 paper labels, 3 plastic seals.



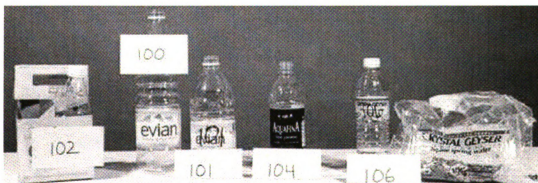
A.42 Vegetable Product Group

Product 219: LDPE plastic bag. Product 220: LDPE plastic bag. Product 222: LDPE plastic bag. Product 223: 2-piece steel can, paper label. Product 224: 3-piece steel can, paper label. Product 225: Paperboard box, foil/plastic/paper laminate wrap.



A.43 Water Product Group

Product 105: PET plastic gallon jug. Product 107: PET plastic bottle with handle. Product 108: HDPE plastic gallon jug. Product 109: HDPE 2.5 gallon jug.



A.44 Water Product Group

Product 100: PET plastic bottle. Product 101: PET plastic bottle. Product 102: Paperboard holder, 4 PET plastic bottles. Product 104: 4 PET plastic bottles, plastic ring holder. Product 106: 6 PET plastic bottles, plastic outer wrap.



A.45 Yogurt Product Group

Product 211: PP plastic cup, HDPE lid, plastic/foil laminate seal. Product 212: PP plastic cup, PS lid, foil seal. Product 213: 6 plastic cups, plastic/foil laminate seals. Product 253: PS plastic tray, plastic/foil laminate seal. Product 254: Paperboard carton, 6 plastic cups with paper/plastic laminate seals.

Appendix B

Master List of Products in Study

Product Number	Product Category	Label Weight oz, fl oz	Description
1	Cereal	18	Paperboard tube, paper tube bottom, plastic lid, plastic film tamper evident seal.
2	Cereal	42	Paperboard tube, paper tube bottom, plastic lid, plastic film seal.
3	Cereal	11.08	Paperboard box, 12 paper/plastic laminate pouches.
4	Cereal	10	Paperboard box, plastic inner pouch with vertical fin back seal.
5	Cereal	20	Paperboard box, plastic inner pouch with vertical fin back seal.
6	Cereal	10	Plastic LDPE bag, vertical fin back seal.
7	Cereal	8	8 paperboard cartons, 8 inner plastic pouches with vertical fin back seal, outer plastic wrap.
8	Soap	15	PET plastic bottle
9	Soap	9	Paperboard box, 2 plastic soap wraps. 2 bars.
10	Soap	15	3 paper/plastic laminate wraps. Outer plastic/foil laminate wrap.
11	Soap	50	10 paper/plastic laminate wraps. Paperboard backing, plastic outer wrap.
12	Soap	9	2 paperboard boxes. Plastic outer wrap.
13	Soap	7.5	Paperboard carton, PET plastic bottle with plastic pump.
14	Soap	10	Paperboard laminate box. 2 bars.
15	Soap	5.75	Paper/plastic soap wrap. Paperboard backing.
16	Soap	7.5	PET plastic bottle with plastic pump.
17	Cookies	18	Paper/foil/plastic laminate bag, corrugated paper tray.
18	Cookies	7.25	Paper/foil/plastic laminate bag, 2 paper cups, 1 paperboard backing tray.
19	Cookies	10	Paperboard tray, plastic outer wrap
20	Cookies	16	Paperboard box, plastic/foil laminate bag
21	Cookies	18	Expanded polystyrene tray, plastic outer wrap, 2 adhesive labels.
22	Cookies	15	Polystyrene tray, plastic outer wrap
23	Cookies	2.85	Plastic/foil laminate pouch
24	Cookies	1.4	Plastic/foil laminate pouch, paperboard tray
25	Cereal	42	Paperboard tube, paper bottom, plastic lid, plastic lid ring, plastic seal.
26	Cereal	18	Paperboard tube, paper bottom, plastic lid, plastic lid ring, plastic seal.
27	Cookies	6.4	Gable-top paperboard box, plastic/foil laminate bag, polystyrene tray.
28	Cookies	22	Paperboard box, 4 plastic inner pouches.
29	Cookies	18	Polystyrene container.
30	Crackers	12	Paperboard box, 3 plastic bags.
31	Crackers	16	Paperboard box, 4 plastic bags.
32	Crackers	16	Paperboard box, 4 plastic bags.
33	Crackers	13	Paper/plastic laminate gusseted bag.
34	Crackers	12	Plastic bag.

35	Chips	6	Plastic/paper laminate bag.
36	Chips	1	Plastic/paper laminate bag.
37	Chips	14	Plastic/paper laminate bag.
38	Chips	7	Paperboard tube, metal bottom, plastic HDPE recloseable lid, paper/foil laminate seal.
39	Chips	14	Paperboard box, 2 foil bags
40	Baking Mix	24	Plastic pillow pouch
41	Baking Mix	8.5	Paperboard box, waxed paper bag.
42	Baking Mix	17.5	Paperboard box, plastic pillow pouch, 2-piece steel can.
43	Baking Mix	80	Paper bag
44	Baking Mix	6.5	Plastic/paper laminate bag.
45	Gum	3.5	Plastic outer wrap, 5 plastic/foil laminate wrappers, 20 paper gum wrappers. 4 packs
46	Gum	3	Plastic outer bag, paper adhesive label, 17 paper gum wrappers
47	Gum	3.8	Plastic outer bag, adhesive label, plastic/foil laminate wrapper, paper wraps, foil wraps. 8 packs.
48	Gum	0.5	Plastic/foil outer wrap. 5 paper wrappers, 5 foil wrappers. 1 pack
50	Pasta	8	Paperboard box, plastic window
51	Pasta	16	Plastic pillow pouch with vertical fin back seal.
52	Pasta	16	Paperboard box, plastic window
53	Pasta	16	Plastic pillow pouch with vertical fin back seal.
54	Pasta	9	Plastic tray, plastic film top seal.
55	Pasta	8	Paper/plastic laminate gusseted bag.
56	Pasta	32	Plastic bag with vertical fin back seal
57	Pasta	8	Expanded polystyrene (EPS) carton, outer plastic wrap.
58	Pasta	12	Plastic bag, adhesive paper seal, adhesive paper label. Bag bunched and sealed at top.
59	Pet Food	36	Plastic HDPE container, plastic lid.
60	Pet Food	13	3 piece metal can. Paper label.
61	Pet Food	5.5	2 piece metal can. Paper label.
62	Pet Food	18	Paperboard box
63	Pet Food	56	Paper/plastic laminate bag
64	Pet Food	3	2 piece metal can. Paper label.
65	Pet Food	3.5	Plastic tray with plastic/foil seal.
66	Pet Food	288	Multi-wall paper bag, plastic inner liner.
67	Pet Food	12	Paperboard box, 6 plastic pouches.
69	Baby Food	16	Paperboard box, plastic outer wrap.
70	Baby Food	8	Paperboard box, plastic outer wrap.
71	Candy	13.8	Plastic outer bag, plastic candy wrap, paper cups, paperboard backing trays.
72	Candy	5.3	Plastic outer bag, foil candy wrap, paper cups.
73	Candy	2.8	Plastic outer wrap, paper cup, paperboard backing
74	Candy	1.5	Plastic outer wrap, plastic candy wrap, paper cup, paperboard backing tray.
75	Candy	6	Plastic outer bag, paperboard tray, plastic candy wrap, paperboard backing, paper cups.
76	Candy	8	Plastic outer bag, foil candy wrap, paper cups.
77	Bread	20	LDPE plastic bag
78	Bread	16	LDPE plastic bag, inner plastic wrap
79	Bread	16	LDPE plastic bag, inner plastic wrap

80	Juice	33	6 3-piece steel can. Plastic ring holder
81	Juice	17	4 paper/plastic/foil laminate tetra-pak boxes. Plastic outer wrap
82	Juice	46	3-piece steel can. Paper label
83	Juice	25.5	3 paper/plastic/foil laminate tetra-pak boxes. Plastic outer wrap
84	Juice	76	9 paper/plastic/foil laminate tetra-pak boxes. Paperboard label, plastic outer wrap.
85	Juice	128	PET plastic bottle with recloseable cap
86	Juice	120	HDPE plastic bottle, recloseable cap
88	Juice	64	Clear glass bottle
89	Juice	67.5	10 plastic/foil laminate pouches, corrugated carton
90	Juice	12	Paperboard tube, metal top and bottom lids, plastic seal.
91	Juice	96	Plastic bottle, foil seal, plastic cap.
92	Juice	127	HDPE plastic gallon jug
93	Juice	32	Paperboard gable-top carton
94	Juice	16	Paperboard gable-top carton
96	Juice	64	Paperboard gable-top carton, plastic spout, plastic cap.
97	Juice	16	Paperboard tube, metal top and bottom lids, plastic seal.
98	Juice	24	3 paperboard gable-top cartons, paperboard holder.
99	Juice	48	6 HDPE plastic bottle. 6 plastic shrinkwrap labels. Plastic outer wrap, paperboard label
100	Water	50.7	PET plastic bottle, plastic screw closure.
101	Water	33.8	PET plastic bottle, plastic screw closure.
102	Water	67.6	4 PET plastic bottles, 4 plastic screw closures. Paperboard carton.
104	Water	80	4 PET plastic bottles, 4 plastic screw closures. Plastic ring holder.
105	Water	136	PET gallon jug
106	Water	100	6 PET bottles, 6 plastic closures. Outer plastic wrap.
107	Water	136	PET bottle with handle
108	Water	128	HDPE gallon jug
109	Water	320	HDPE 2.5 gallon jug, plastic spout.
110	Laundry Detergent	50	HDPE plastic bottle with cap
111	Laundry Detergent	200	HDPE plastic bottle with cap
112	Laundry Detergent	90	HDPE plastic bottle with cap
113	Laundry Detergent	186	Paperboard box, plastic strap.
114	Laundry Detergent	22	Paperboard box
115	Laundry Detergent	142	Plastic bag
116	Laundry Detergent	39	Paperboard box
117	Drink Mix	11.5	Aluminum can
118	Drink Mix	19	HDPE Plastic container, screw on top. Plastic label on outside.
119	Drink Mix	1.4	Paperboard box with 4 plastic/foil/paper laminate pouches.
120	Drink Mix	1.8	Plastic tube with 6 plastic foil sealed cups. Plastic outer label.
121	Drink Mix	19	Paperboard tube with metal top/bottom. Paper label, HDPE plastic recloseable lid
122	Tissue	Pocket	8 plastic wraps. Plastic outer wrap.

123	Tissue	Pack Cold Care	Paperboard box, plastic window, plastic outer wrap.
124	Tissue	Unsc ented	Paperboard box, plastic window
125	Tissue	Travel ers	3 Paperboard boxes, plastic outer wrap.
126	Tissue	Family Pack	Paperboard box, plastic window.
127	Tissue	Travel Tissue s	6 recloseable plastic pouches. Plastic outer wrap.
128	Toilet Tissue	4 rolls	4 toilet tissue rolls. Plastic outer wrap.
129	Toilet Tissue	12 rolls	12 toilet tissue rolls. Plastic outer wrap.
130	Toilet Tissue	1 roll	Paper wrapped single toilet tissue roll.
133	Baby Food	4	Clear glass jar, paper label.
134	Gum	0.6	Paperboard sleeve, plastic blister pack, foil seal. 12 pieces.
135	Soft Drinks	288	Paperboard box, 24 aluminum cans.
136	Soft Drinks	120	6 PET plastic bottle, plastic ring holder.
137	Soft Drinks	32	Brown glass bottle, plastic cap.
138	Soft Drinks	100	Plastic PET bottle
139	Soft Drinks	72	6 Aluminum cans, plastic ring holder
140	Soft Drinks	144	12 aluminum cans, plastic outer wrap.
141	Soft Drinks	67	Plastic PET bottle
142	Soft Drinks	48	6 clear glass bottles, paperboard carton.
143	Soft Drinks	20	PET plastic bottle, plastic cap.
144	Soft Drinks	144	12 aluminum cans, paperboard box.
146	Baby Food	0.5	Plastic/foil/paper laminate pouch
147	Cheese	22.7	Vacuum packed plastic pouch sealed with vertical fin back seal.
148	Cheese	23.9	Inner plastic wrap with outer wax coating
149	Cheese	48	Paperboard carton with individual plastic wrapped cheese. 4 outer plastic wraps.
150	Cheese	12	Plastic individual cheese wrappers with outer plastic wrap.
151	Cheese	8	Plastic recloseable bag
152	Cheese	8	Plastic pouch with vertical fin back seal. Paperboard and paper backing.
153	Cheese	8	LDPE recloseable bag with internal plastic wrap.
154	Cheese	8	HDPE cup with HDPE lid. Plastic film seal.
155	Cheese	10	Ceramic cannister, rubber gasket, metal handle. Plastic internal cheese wrap.
156	Cheese	14	PP cup with recloseable lid. Plastic film seal.
157	Lunch Meat	10	Plastic sealed pouch LDPE
158	Lunch Meat	6	Paperboard outer carton, plastic pouch.
159	Lunch Meat	7	Plastic recloseable pouch
160	Lunch Meat	8	LDPE recloseable bag, plastic inner wrap.
161	Milk	64	HDPE 1/2 gallon plastic jug
162	Milk	128	HDPE plastic gallon jug

163	Milk	64	Paperboard laminated gable-top carton
164	Milk	32	Paperboard laminated gable-top carton
165	Milk	8	Paperboard laminated gable-top carton
166	Milk	16	PET bottle
167	Margarine	16	Paperboard carton, 2 Polypropylene cups, 2 plastic lids.
168	Margarine	16	Paperboard carton, 4 aluminum wrappers.
169	Margarine	12	HDPE bottle with foil seal
170	Margarine	32	HDPE tub, LDPE plastic lid.
171	Eggs	21	Polystyrene foam carton
172	Eggs	21	Paper molded carton
173	Cleaner	32	HDPE bottle with recloseable cap
174	Eggs	42	Paper molded carton, plastic outer wrap.
175	Cleaner	35	HDPE bottle with recloseable cap
176	Dish Soap	42	PET bottle, recloseable cap
177	Dish Soap	14.7	PET bottle, recloseable cap
178	Dish Soap	42.7	HDPE bottle, recloseable cap
179	Dish Soap	28	HDPE bottle, recloseable cap
180	Dish Soap	50	Paperboard box with foil/plastic outer label.
181	Dish Soap	85	HDPE plastic bottle
182	Paper Towel	3 rolls	3 Paper towel rolls. LDPE plastic outer wrap.
183	Paper Towel	1 roll	1 Paper towel roll. LDPE plastic outer wrap.
184	Paper Towel	8 rolls	8 Paper towel rolls. 8 LDPE plastic wraps. LDPE plastic outer wrap.
185	Dinners	26	Paperboard carton, PS tray, Paper/plastic baking tray. Foil/plastic pouch, plastic pouch, outer plastic wrap.
186	Dinners	18.2	Outer plastic fin sealed pouch. Inner plastic pouch, inner plastic mesh pouch.
187	Dinners	28	Paperboard outer carton, plastic/foil laminate pouch
188	Dinners	7.25	Paperboard outer carton, plastic/foil laminate pouch
189	Dinners	15	Paperboard outer carton, plastic/foil laminate pouch
190	Dinners	14	Paperboard outer carton, plastic/foil laminate pouch
191	Dinners	12.15	Paperboard outer carton, plastic film seal, inner PET tray.
192	Dinners	10	Paperboard outer carton, plastic tray, plastic film seal.
193	Dinners	14.5	3 piece can with paper label
194	Tomato Product	64	PET bottle, plastic/foil seal. PP cap.
195	Tomato Product	20	PET bottle, plastic/foil seal. PP cap.
196	Tomato Product	40	Plastic bottle, plastic/foil seal. PP cap.
197	Tomato Product	28	Plastic bottle, plastic/foil seal. PP cap.
198	Meat	34	Plastic film laminated expanded polystyrene (EPS) tray. Plastic film seal.
199	Meat	17.5	Plastic film laminated expanded polystyrene (EPS) tray. Plastic film seal.
200	Meat	44.7	Expanded Polystyrene (EPS) tray, plastic outer wrap.
201	Meat	22.5	Expanded Polystyrene (EPS) tray, plastic outer wrap.

202	Poultry	59	LDPE bag.
203	Poultry	73.2	Polystyrene tray, plastic label. Plastic outer wrap.
204	Soup	1.9	PB box, 4 plastic/foil/paper laminate pouches.
205	Soup	4.4	Paper/foil/plastic laminate pouch.
206	Soup	1.5	Paperboard cup, plastic/paper laminate seal.
207	Soup	33.1	Paperboard box, 2 HDPE plastic trays. 2 Plastic film seals.
208	Soup	10.5	2 piece steel can, paper label.
209	Soup	19	3 piece steel can, paper label
210	Soup	24	Clear glass jar with metal lug cap.
211	Yogurt	32	Polypropylene cup, plasti lid, foil seal.
212	Yogurt	8	Polypropylene cup, Polystyrene lid, foil seal.
213	Yogurt	26.4	6 PP plastic cups, plastic/foil seals.
214	Fruit	64	Plastic mesh bag. Plastic label.
215	Fruit	26	Clear glass jar. Metal lug cap
216	Fruit	15	3 piece metal can. Paper label.
217	Fruit	29	3 piece metal can. Paper label.
218	Fruit	16	4 3-piece steel cans, paperboard carton, 4 paper labels.
219	Vegetables	48	LDPE bag
220	Vegetables	16	LDPE bag
221	Fruit	16	HDPE plastic bag
222	Vegetables	16	LDPE lap sealed bag
223	Vegetables	14.5	2-piece steel can. Paper label.
224	Vegetables	8.25	3-piece steel can. Paper label
225	Vegetables	10	Paperboard box, foil/paper/plastic wrap.
226	Toothpaste	6.4	Paperboard box, plastic/foil tube, recloseable cap.
227	Toothpaste	4	Paperboard box, plastic/foil tube, recloseable cap.
228	Toothpaste	0.85	Paperboard box, plastic/foil tube, relcloseable cap.
229	Toothpaste	6	Plastic self-standing laminate tube. Flip-top cap, foil seal.
230	Toothpaste	6	Plastic self-standing plastic tube. Foil/plastic inner pouch. Plastic seal.
231	Toothpaste	3.5	Paperboard box, 2-piece plastic pump.
232	Shampoo	15	HDPE container
233	Shampoo	15	PET container
234	Shampoo	6.8	HDPE container
235	Shampoo	2	HDPE container
236	Ice Cream	90	HDPE plastic tub, plastic lid
237	Ice Cream	42	Laminated Paperboard container.
238	Ice Cream	39	Laminated paperboard container, LDPE plastic lid.
239	Ice Cream	48	Laminated paperboard container, paperboard lid, plastic window.
240	Ice Cream	30	Laminated Paperboard cup, plastic lid.
241	Tuna Fish	6	2-piece steel can, paper label.
242	Tuna Fish	8.25	Paperboard carton, 3 2-piece steel cans, 3 paper labels.
243	Beer	150	Paperboard box with 12 aluminum cans
244	Beer	300	Paperboard box with 24 aluminum cans
245	Beer	150	Corrugated box with 12 amber glass bottles
246	Beer	40	Amber glass bottle
247	Beer	72	6 aluminum cans. Plastic ring holder.
248	Beer	72	6 amber long neck glass bottles. Paperboard carton.
249	Cleaner	27	PET plastic bottle with recloseable cap
250	Cleaner	27	Paperboard laminate box

251	Milk	32	HDPE plastic bottle. Plastic shrinkwrap label.
252	Milk	48	6 HDPE plastic bottle. 6 plastic shrinkwrap labels. Plastic outer wrap.
253	Yogurt	6	Polystyrene tray, plastic/foil laminant seal.
254	Yogurt	24	6 PP plastic cups, 6 plastic/paper seals, paperboard carton.
255	Tuna Fish	12	2-piece steel can, paper label
256	Tuna Fish	8.25	Paperboard carton, 3 2-piece steel cans, 3 PET plastic containers, 3 paper labels, 3 plastic seals.
257	Margarine	16	Paperboard carton, 4 paper wrappers.
258	Eggs	42	Expanded polystyrene (EPS) carton, outer plastic wrap.
259	Drink Mix	0.16	Plastic/foil/paper laminate pouch
260	Milk	64	LDPE plastic pouch

* The numbers 49, 68, 87, 95, 103,131,132 and 145 were left out of this study for various reasons.

Appendix C

Additional Product Category Data Tables

C.1 Baby Food Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
69	Baby Food	Gerber	454	16	459.62	18.385	25.000	30	15	60
					459.62	18.385	25.000	30		60
					459.62	18.385	25.000	30		60
70	Baby Food	Gerber	227	8	223.38	8.935	25.000	15	15	60
					223.38	8.935	25.000	15		60
					223.38	8.935	25.000	15		60
133	Baby Food	Gerber	113	4	106.7	6.097	17.500	8	14	80
					106.7	6.097	17.500	8		80
					106.7	6.097	17.500	8		80
146	Baby Food	Gerber	14	0.5	15.96	0.684	23.333	1	14	60
					15.96	0.684	23.333	1		60

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
69	TOTAL	75.158	2541.65	0.064	95.448	Paperboard box, plastic outer wrap
	PB box	72.388	1508.45	0.0617	93.071	
	Plastic outer wrap	2.770	1033.20	0.0023	2.376	
70	TOTAL	44.865	1715.840	0.051	51.202	Paperboard box, plastic outer wrap
	PB box	42.375	1031.84	0.0477	49.219	
	Plastic outer wrap	2.490	684.00	0.0029	1.984	
133	TOTAL	78.450	190.96	0.3765	55.840	Clear glass jar, metal lug cap
	Clear glass jar	71.740	156.07	0.3524	54.999	
	Metal lid	6.710	34.89	0.0241	0.841	
146	TOTAL	2.350	223.520	0.011	2.347	Plastic/paper/foil laminate pouch
	Plastic/foil laminate pouch	2.350	223.52	0.0105	2.347	

C.2 Baking Mix Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
40	Baking Mix	Bob's Red Mill	679	24	684.34	40.438	16.923	30	22	130
					684.34	40.438	16.923	30		130
41	Baking Mix	Jiffy	240	8.5	246.03	10.359	23.750	6	38	160
					246.03	10.359	23.750	6		160
					246.03	10.359	23.750	6		160
42	Baking Mix	Krusteaz	496	17.5	496.3	15.736	31.538	11	41	130
					496.3	15.736	31.538	11		130

					496.3	15.736	31.538	11		130
					496.3	15.736	31.538	11		130
43	Baking Mix	Aunt Jemima	2260	80	2263.18	72.422	31.250	91	25	80
					2263.18	72.422	31.250	91		80
44	Baking Mix	Gold Medal	184	6.5	193.67	6.872	28.182	6	31	110
					193.67	6.872	28.182	6		110

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume, cm3	Material, Description
40	TOTAL	7.840	181.600	0.005	0.908	Plastic pillow pouch
	Plastic pouch	7.840	181.60	0.0050	0.908	
41	TOTAL	21.120	985.770	0.052	24.440	Paperboard box,
	PB box	17.470	459.02	0.0459	21.069	Waxed paper bag
	Paper(waxed) bag	3.650	526.75	0.0064	3.371	
42	TOTAL	71.060	1800.39	0.1120	61.377	Paperboard box,
	PB box	37.290	862.46	0.0537	46.314	Plastic pillow pouch
	2-piece Steel Can	29.060	188.01	0.0510	9.589	2-piece steel can
	Pillow pouch	4.710	749.92	0.0073	5.474	
43	TOTAL	22.430	1543.160	0.012	19.135	Paper bag
	Paper bag	22.430	1543.16	0.0124	19.135	
44	TOTAL	6.850	530.860	0.011	5.946	Plastic/paper laminate bag
	Plastic bag	6.850	530.86	0.0112	5.946	

C.3 Beer Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl.oz.	Measured Weight, ml	Measured Weight, fl.oz.	Uses per container, 100 cal. Basis	Serving Size	Manufacturer Serving	Serving Size, ml	Calorie per serving
243	Beer	Bud Light	4260	150	4298	145.32	11.86	362.24	12	355	98
					4298	145.32	11.86	362.24	12	355	98
					4298	145.32	11.86	362.24	12	355	98
244	Beer	Bud Light	8520	300	8631	291.81	23.83	362.24	24	355	98
					8631	291.81	23.83	362.24	24	355	98
					8631	291.81	23.83	362.24	24	355	98
245	Beer	Coors Light	4260	150	4352	147.14	12.01	362.24	12	355	98
					4352	147.14	12.01	362.24	12	355	98
					4352	147.14	12.01	362.24	12	355	98
246	Beer	Bud Light	1183	40	1197	40.47	3.30	362.24	3	355	98
					1197	40.47	3.30	362.24	3	355	98
247	Beer	Bud Light	2130	72	2146	72.56	5.92	362.24	6	355	98
					2146	72.56	5.92	362.24	6	355	98
					2146	72.56	5.92	362.24	6	355	98
248	Beer	Bud Light	2130	72	2289	77.39	6.32	362.24	6	355	98
					2289	77.39	6.32	362.24	6	355	98
					2289	77.39	6.32	362.24	6	355	98

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
243	TOTAL	377.50	9970.26	0.07	289.42	Paperboard box with 12
	PB box	200.56	4023.120	0.054	218.053	aluminum cans
	12 aluminum cans	176.94	5947.140	0.012	71.366	
244	TOTAL	756.17	19908.41	0.07	606.80	Paperboard box with 24
	PB box	398.76	7895.480	0.059	465.044	aluminum cans
	24 aluminum cans	357.41	12012.930	0.012	141.753	
245	TOTAL	2235.78	3926.59	0.05	1347.69	Corrugated box with 12
	Corrugated box	173.22	3926.590	0.054	212.036	amber glass bottles
	12 amber glass bottles	2062.56			1135.650	
246	TOTAL	398.79	0.00	0.00	368.75	Amber glass bottle
	Amber Glass bottle	398.79			368.750	
247	TOTAL	96.00	3164.01	0.04	46.20	6 aluminum cans. Plastic
	6 aluminum cans	92.35	3081.360	0.014	43.755	ring holder
	plastic ring holder	3.65	82.650	0.030	2.446	
248	TOTAL	1606.19	1526.35	0.04	890.22	6 amber long neck glass
	6 amber glass bottle	1548.23			827.640	bottles. Paperboard carton
	PB carton	57.96	1526.350	0.041	62.580	

C.4 Bread Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
77	Bread	Lumber Jack	567	20	592.2	16.920	35.000	20	28	80
					592.2	16.920	35.000	20		80
78	Bread	Pepperidge Farms	454	16	458.76	11.214	40.909	10	45	110
					458.76	11.214	40.909	10		110
					458.76	11.214	40.909	10		110
79	Bread	Pepperidge Farms	454	16	450.72	12.677	35.556	14	32	90
					450.72	12.677	35.556	14		90
					450.72	12.677	35.556	14		90

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
77	TOTAL	9.970	2375.900	0.005	10.692	LDPE outer bag
	LDPE bag	9.970	2375.90	0.0045	10.692	
78	TOTAL	6.760	2732.260	0.004	5.111	LDPE outer bag, inner plastic wrap
	LDPE outer bag	4.180	1607.84	0.0022	3.537	
	Inner plastic wrap	2.580	1124.42	0.0014	1.574	
79	TOTAL	8.020	2968.88	0.0048	7.125	LDPE outer bag, inner plastic wrap
	LDPE outer bag	4.430	1730.48	0.0024	4.153	
	Inner plastic wrap	3.590	1238.40	0.0024	2.972	

C.5 Candy Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
71	Candy	Reese's	391	13.8	406.11	22.694	17.895	12	34	190
					406.11	22.694	17.895	12		190
					406.11	22.694	17.895	12		190
					406.11	22.694	17.895	12		190
					406.11	22.694	17.895	12		190
72	Candy	Reese's	150	5.3	151.62	8.164	18.571	4	39	210
					151.62	8.164	18.571	4		210
					151.62	8.164	18.571	4		210
					151.62	8.164	18.571	4		210
73	Candy	Reese's	79	2.8	79.81	4.243	18.810	1	79	420
					79.81	4.243	18.810	1		420
					79.81	4.243	18.810	1		420
					79.81	4.243	18.810	1		420
74	Candy	Reese's	45	1.5	45.08	2.504	18.000	1	45	250
					45.08	2.504	18.000	1		250
					45.08	2.504	18.000	1		250
					45.08	2.504	18.000	1		250
75	Candy	Reese's	170	6	172.91	9.663	17.895	5	34	190
					172.91	9.663	17.895	5		190
					172.91	9.663	17.895	5		190
					172.91	9.663	17.895	5		190
					172.91	9.663	17.895	5		190
76	Candy	Reese's	226	8	226.4	12.191	18.571	6	39	210
					226.4	12.191	18.571	6		210
					226.4	12.191	18.571	6		210
					226.4	12.191	18.571	6		210

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
71	TOTAL	33.540	6869.390	0.083	81.282	Plastic outer bag, individual
	Plastic outer bag	9.180	1207.68	0.0074	8.937	plastic wrapped candy. Candy
	Plastic candy wrap	8.790	4141.20	0.0049	20.292	contained in paper cup, paperboard
	PB backing	12.030	699.84	0.0460	32.193	tray
	Paper cup	3.540	820.67	0.0242	19.860	
72	TOTAL	9.720	1985.810	0.013	8.661	Plastic outer bag, individual
	Plastic outer bag	3.580	552.00	0.0059	3.257	foil wrapped candies. Candy
	foil wrapper	3.560	992.80	0.0038	3.773	contained in paper cup
	paper cup	2.580	441.01	0.0037	1.632	
73	TOTAL	7.830	749.610	0.036	7.455	Plastic outer wrapping, candy
	Plastic outer wrap	1.830	433.44	0.0055	2.384	contained inside paper cup,
	PB tray	3.140	170.98	0.0255	4.360	paperboard tray
	Paper cup	2.860	145.19	0.0049	0.711	
74	TOTAL	3.120	434.430	0.032	3.655	Plastic outer wrap, plastic candy
	Plastic outer wrap	1.120	263.16	0.0045	1.184	wrap, paper cup, paperboard
	PB tray	1.630	92.13	0.0239	2.202	backing tray
	Paper cup	0.370	79.14	0.0034	0.269	
75	TOTAL	32.620	3848.060	0.090	45.395	Plastic outer bag, paperboard
	Plastic outer bag	2.850	976.08	0.0038	3.709	tray. Plastic candy wrap,

	PB tray	17.190	477.40	0.0523	24.968	paperboard
	PB backing	5.220	291.60	0.0255	7.436	backing, paper cups
	Paper cup	1.660	362.98	0.0040	1.452	paper cups
	Plastic candy wrap	5.700	1740.00	0.0045	7.830	
76	TOTAL	15.400	2683.630	0.011	8.234	Plastic outer bag, foil wrapper,
	Plastic outer bag	4.000	597.84	0.0057	3.408	paper cup
	Foil wrapping	5.480	1449.00	0.0021	3.043	
	Paper cup	5.920	636.79	0.0028	1.783	

C.6 Cereal Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
1	Cereal	Quaker Oats	510	18	519.37	19.476	26.667	13	40	150
					519.37	19.476	26.667	13		150
					519.37	19.476	26.667	13		150
					519.37	19.476	26.667	13		150
					519.37	19.476	26.667	13		150
2	Cereal	Quaker Oats	1190	42	1218.45	45.692	26.667	30	40	150
					1218.45	45.692	26.667	30		150
					1218.45	45.692	26.667	30		150
					1218.45	45.692	26.667	30		150
					1218.45	45.692	26.667	30		150
					1218.45	45.692	26.667	30		150
					1218.45	45.692	26.667	12		150
3	Cereal	Quaker Instant Oats	336	11.08	376.06	13.431	28.000	12	28	100
					376.06	13.431	28.000	12		100
					376.06	13.431	28.000	12		100
25	Cereal	Meijer Quick Oats	1190	42	1233.3	44.272	27.857	31	39	140
					1233.3	44.272	27.857	31		140
					1233.3	44.272	27.857	31		140
					1233.3	44.272	27.857	31		140
					1233.3	44.272	27.857	31		140
26	Cereal	Meijer Quick Oats	510	18	517.55	18.579	27.857	13	39	140
					517.55	18.579	27.857	13		140
					517.55	18.579	27.857	13		140
					517.55	18.579	27.857	13		140
4	Cereal	Cheerios	283	10	284.31	10.425	27.273	9	30	110
					284.31	10.425	27.273	9		110
					284.31	10.425	27.273	9		110
5	Cereal	Cheerios	567	1lb 4oz	567.87	20.822	27.273	19	30	110
					567.87	20.822	27.273	19		110
					567.87	20.822	27.273	19		110
6	Cereal	Kroger Toasted Oats	283	10	285.94	10.484	27.273	9	30	110
					285.94	10.484	27.273	9		110
7	Cereal	General Mills			255.86	9.806	26.092	8	227	870

			255.86	9.806	26.092	8	227	870
	Cheerios	21	22.67	0.864	26.250	8	21	80
			22.67	0.864	26.250	8	21	80
	Frosted Cheerios	29	29.51	1.119	26.364	8	29	110
			29.51	1.119	26.364	8	29	110
	French Toast	30	35.43	1.417	25.000	8	30	120
			35.43	1.417	25.000	8	30	120
	Trix	27	26.48	0.981	27.000	8	27	100
			26.48	0.981	27.000	8	27	100
	Honey Clusters	36	44.8	1.742	25.714	8	36	140
			44.8	1.742	25.714	8	36	140
	Honey Cheerios	28	30.19	1.186	25.455	8	28	110
			30.19	1.186	25.455	8	28	110
	Cinn. Streusel	27	36.38	1.347	27.000	8	27	100
			36.38	1.347	27.000	8	27	100
	Lucky Charms	29	30.4	1.153	26.364	8	29	110
			30.4	1.153	26.364	8	29	110

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
1	TOTAL	61.790	938.09	0.4506	206.783	Paperboard tube, paper tube bottom
	PB can	51.540	722.36	0.2733	197.420	plastic lid, plastic film tamper
	PB lid	2.010	87.40	0.0349	3.050	evident seal.
	Plastic lid	7.410	41.93	0.1347	5.648	
	Plastic film	0.830	86.40	0.0077	0.665	
2	TOTAL	108.550	1607.49	0.4167	135.576	Paperboard tube, paper tube bottom
	Paper top	3.360	151.74	0.0315	4.780	plastic lid, film seal, plastic lid ring,
	Plastic lid ring	3.500	13.91	0.0720	1.002	paper seal, adhesive.
	Paper seal	2.800	128.68	0.0315	4.053	
	Plastic seal	6.540	28.63	0.1072	3.069	
	ring					
	adhesive	3.190	22.56	0.0787	1.775	
	PB can	89.160	1261.97	0.0958	120.897	
3	TOTAL	44.480	1510.07	0.0521	76.535	Paperboard carton, 12 paper/plastic
	PB box	1.420	1250.07	0.0460	57.503	laminate pouches.
	plastic packet	43.060	260.00	0.0061	19.032	
25	TOTAL	119.836	1513.44	0.3774	140.696	Paperboard tube, paper bottom,
	Plastic ring	3.980	8.17	0.0815	0.666	plastic lid, plastic lid ring, plastic
	Inner lid	7.660	116.83	0.0559	6.531	seal, adhesive
	adhesive	3.426	23.90	0.0762	1.821	
	Outer lid	10.410	176.63	0.0622	10.986	
	PB can	94.360	1187.91	0.1016	120.692	
26	TOTAL	68.360	884.96	0.3010	76.365	Paperboard tube, paper bottom,
	1st seal	6.230	83.32	0.0587	4.891	plastic lid, plastic lid ring, plastic
	2nd seal	5.350	70.88	0.0635	4.501	seal, adhesive
	plastic ring	2.490	8.19	0.0871	0.713	
	paper tube	54.290	722.57	0.0917	66.260	
4	TOTAL	84.490	3663.19	0.1947	104.829	Paperboard box, plastic inner pouch
	PB box	74.630	1794.79	0.0506	90.816	with vertical fin back seal
	plastic bag	9.860	1868.40	0.0075	14.013	

5	TOTAL	148.990	5479.920	0.068	186.717	Paperboard box, plastic inner pouch with vertical fin back seal
	Pb box	134.670	2732.22	0.0614	167.758	
	plastic bag	14.320	2747.70	0.0069	18.959	
6	TOTAL	6.540	3253.12	0.0073	23.748	Plastic LDPE bag, vertical fin back seal
	plastic bag	6.540	3253.12	0.0073	23.748	
7	TOTAL	139.790	7317.50	0.3983	160.908	8 paperboard cartons, 8 plastic inner pouches with vertical fin back seals, plastic outer wrap.
	Plastic outer	3.590	1454.38	0.0023	3.345	
	PB box	13.650	416.49	0.0403	16.785	
	Plastic bag	3.150	316.40	0.0092	2.911	
	box	14.260	416.49	0.0403	16.785	
	bag	3.120	316.40	0.0092	2.911	
	box	13.640	416.49	0.0403	16.785	
	bag	3.080	316.40	0.0092	2.911	
	box	13.850	416.49	0.0403	16.785	
	bag	3.330	316.40	0.0092	2.911	
	box	13.900	416.49	0.0403	16.785	
	bag	3.250	316.40	0.0092	2.911	
	box	14.060	416.49	0.0403	16.785	
	bag	3.110	316.40	0.0092	2.911	
	box	13.800	416.49	0.0403	16.785	
	bag	3.150	316.40	0.0092	2.911	
	box	13.910	416.49	0.0403	16.785	
	bag	2.940	316.40	0.0092	2.911	

C.7 Cheese Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving size 100 cal basis	Manufacturer Servings	Serving Size, g	Calories/ Serving
147	Cheese	Kroger	644	22.7	659	25.889	25.455	23	28	110
					659	25.889	25.455	23	28	110
148	Cheese	Land O' Lakes	680	23.9	698	27.421	25.455	24	28	110
					698	27.421	25.455	24	28	110
					698	27.421	25.455	24	28	110
149	Cheese	Kroger	1360	48	1374	43.389	31.667	72	19	60
					1374	43.389	31.667	72	19	60
					1374	43.389	31.667	72	19	60
					1374	43.389	31.667	72	19	60
150	Cheese	Kraft	340	12	344	11.467	30.000	16	21	70
					344	11.467	30.000	16	21	70
					344	11.467	30.000	16	21	70
151	Cheese	Kraft	227	8	243	9.720	25.000	8	30	120
					243	9.720	25.000	8	30	120
152	Cheese	Alpine Lace	240	8	244	6.100	40.000	9	28	70
					244	6.100	40.000	9	28	70
					244	6.100	40.000	9	28	70
					244	6.100	40.000	9	28	70
153	Cheese	Kroger Deli	231	8	233	9.154	25.455	8	28	110
					233	9.154	25.455	8	28	110
					233	9.154	25.455	8	28	110
154	Cheese	Kaukauna	227	8	235	7.554	31.111	8	28	90
					235	7.554	31.111	8	28	90
					235	7.554	31.111	8	28	90
					235	7.554	31.111	8	28	90

155	Cheese	Win Schuler's	284	10	298	9.579	31.111	10	28	90
					298	9.579	31.111	10	28	90
					298	9.579	31.111	10	28	90
					298	9.579	31.111	10	28	90
					298	9.579	31.111	10	28	90
156	Cheese	Win Schuler's	397	14	408	8.743	46.667	14	28	60
					408	8.743	46.667	14	28	60
					408	8.743	46.667	14	28	60
					408	8.743	46.667	14	28	60

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
147	TOTAL	7.41	715.36	0.01	4.94	Vacuum sealed plastic pouch
	Plastic bag	7.41	715.360	0.007	4.936	Fin sealed 3-sided pouch
148	TOTAL	49.52	954.05	0.13	60.62	Inner plastic wrap with outer wax coating
	Wax	44.20	479.650	0.125	59.764	
	Plastic wrap	5.32	474.400	0.002	0.854	
149	TOTAL	81.25	17544.47	0.05	99.92	Paperboard carton with individual plastic wrapped cheese. 4 outer plastic wrappings
	PB carton	38.18	1073.140	0.047	50.867	
	Plastic cheese wrap	37.43	14647.680	0.003	43.943	
	Plastic outer wrap	5.64	1823.650	0.003	5.106	
150	TOTAL	9.90	3731.36	0.01	11.43	Plastic individual cheese wrappings with outer plastic wrap
	Plastic cheese wrap	8.32	3255.040	0.003	9.765	
	Plastic outer wrap	1.58	476.320	0.004	1.667	
151	TOTAL	8.61	997.59	0.01	8.18	Plastic recloseable bag
	Plastic pouch	8.61	997.590	0.008	8.180	
152	TOTAL	17.40	1540.30	0.07	18.04	Plastic fin sealed pouch. Paperboard backing, paper cheese backing.
	Plastic outer wrap	6.08	678.370	0.005	3.188	
	Paper backing	4.14	672.970	0.006	4.172	
	PB backing	7.18	188.960	0.057	10.676	
153	TOTAL	5.64	1666.14	0.01	6.37	LDPE recloseable bag with plastic wrap sheet.
	Plastic bag	4.94	1122.100	0.005	5.611	
	Plastic inner wrap	0.70	544.040	0.001	0.762	
154	TOTAL	13.75	297.74	0.12	14.18	HDPE cup with recloseable HDPE lid. Plastic seal.
	Plastic cup	9.97	177.120	0.061	10.787	
	plastic lid	3.46	57.540	0.053	3.050	
	Plastic film	0.32	63.080	0.006	0.347	
155	TOTAL	550.80	1615.22	1.06	295.42	Ceramic cannister with rubber gasket and metal handle. Plastic cheese wrap inside
	Ceramic jar	519.94	491.630	0.580	285.195	
	Plastic wrap	4.00	1095.930	0.004	4.493	
	Rubber gasket	4.39	18.960	0.156	2.952	
	Metal handle	22.47	8.700	0.320	2.784	
156	TOTAL	24.19	578.96	0.12	26.50	PP cup with recloseable lid. Plastic film seal
	Plastic tub	13.16	282.670	0.052	14.784	
	Plastic lid	10.38	182.900	0.060	11.047	
	Plastic film	0.65	113.390	0.006	0.669	

C.8 Chip Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
35	Potato Chips	Jays	170	6	172.33	9.232	18.667	6	28	150
					172.33	9.232	18.667	6		150
36	Potato Chips	Lays	28.3	1	30.45	1.614	18.867	1	28.3	150
					30.45	1.614	18.867	1		150
37	Potato Chips	Ruffles	396.9	14	397.8	22.731	17.500	14	28	160
					397.8	22.731	17.500	14		160
38	Potato Chips	Pringles	198	7	198.95	11.369	17.500	7	28	160
					198.95	11.369	17.500	7		160
					198.95	11.369	17.500	7		160
					198.95	11.369	17.500	7		160
39	Potato Chips	Pringles	397	14	390.75	22.329	17.500	14	28	160
					390.75	22.329	17.500	14		160
					390.75	22.329	17.500	14		160

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
35	TOTAL	9.000	1482.480	0.007	10.229	Plastic/Paper laminate bag
	Plastic/paper laminate bag	9.000	1482.48	0.0069	10.229	
36	TOTAL	2.210	471.040	0.006	2.591	Plastic/paper laminate bag
	Plastic/paper laminate bag	2.210	471.04	0.0055	2.591	
37	TOTAL	13.470	2435.280	0.006	15.586	Plastic/paper laminate bag
	Plastic/paper laminate bag	13.470	2435.28	0.0064	15.586	
38	TOTAL	54.121	1046.140	0.164	74.483	Paperboard tube, metal bottom,
	PB tube w/ metal bottom	49.150	653.85	0.0907	59.304	plastic HDPE recloseable lid,
	Plastic Lid	4.321	210.83	0.0627	13.219	paper/foil laminate seal
	Foil lid	0.650	181.46	0.0108	1.960	
39	TOTAL	66.450	3045.060	0.056	74.118	Paperboard box, 2 foil bags
	PB box	50.960	1227.36	0.0478	58.668	
	Foil bags	15.490	1817.70	0.0085	15.450	

C.9 Cleaner Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Uses per container, 1/4 cup basis	Manufacturer Use	Serving Size, ml
173	Cleaner	Mop & Glo	946	32	958	16.21	16	59
					958	16.21	16	59
175	Cleaner	Lysol	1034	35	1049	17.75	17	59
					1049	17.75	17	59
249	Cleaner	Future	799	27	812	13.74	13	59
					812	13.74	13	59

Powder							
			g	oz	g		1/4 cup, g
250	Cleaner	Spic & Span	765	27	774	25.80	24
					774	25.80	24
							30
							30

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume material, cm3	Description
173	TOTAL	59.45	605.31	0.10	58.90	HDPE bottle with recloseable
	Plastic bottle	59.45	605.310	0.097	58.897	cap
175	TOTAL	73.26	748.21	0.11	82.08	HDPE bottle with recloseable
	Plastic bottle	73.26	748.210	0.110	82.079	screw cap
249	TOTAL	51.33	725.19	0.06	45.18	PET plastic bottle with
	Plastic PET bottle	51.33	725.190	0.062	45.179	recloseable cap

Powder						
250	TOTAL	70.37	1384.07	0.06	87.20	Paperboard laminate box
	PB laminated box	70.37	1384.070	0.063	87.196	

C.10 Cookie Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
17	Cookies	Nabisco Chips Ahoy!	510	18	513.55	25.678	20.000	16	32	160
					513.55	25.678	20.000	16		160
					513.55	25.678	20.000	16		160
18	Cookies	Pepperidge Farm	206	7.25	211.17	10.559	20.000	8	26	130
					211.17	10.559	20.000	8		130
					211.17	10.559	20.000	8		130
					211.17	10.559	20.000	8		130
19	Cookies	Archway	283	10	326.17	16.309	20.000	12	28	140
					376.06	16.309	20.000	12		140
					376.06	16.309	20.000	12		140
20	Cookies	Famous Amos	453	16	455.79	19.751	23.077	16	30	130
					455.79	19.751	23.077	16		130
					455.79	19.751	23.007	16		130
21	Cookies	Kroger	510	18	568.75	29.418	19.333	24	29	150
					568.75	29.418	19.333	24		150
					568.75	29.418	19.333	24		150
					568.75	29.418	19.333	24		150
22	Cookies	Keebler E.L. Fudge	425	15	448.85	21.545	20.833	17	25	120
					448.85	21.545	20.833	17		120
					448.85	21.545	20.833	17		120
23	Cookies	Nabisco Chips Ahoy!	78	2.75	81.67	3.351	24.375	2	39	160
					81.67	3.351	24.375	2		160
24	Cookies	Nabisco Chips Ahoy!	40	1.4	41.9	2.095	20.000	1	40	200
					41.9	2.095	20.000	1		200
					41.9	2.095	20.000	1		200
27	Cookies	Pepperidge Farms	180	6.4	190.04	6.335	30.000	10	18	60

					190.04	6.335	30.000	10		60
					190.04	6.335	30.000	10		60
					190.04	6.335	30.000	10		60
28	Cookies	Nabisco Chips Ahoy!	680	22	751.88	37.594	20.000	21	32	160
					751.88	37.594	20.000	21		160
					751.88	37.594	20.000	21		160
29	Cookies	Goff's	510	18	544.8	28.179	19.333	12	29	150
					544.8	28.180	19.333	12		150

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
17	TOTAL	23.090	2266.96	0.052	62.269	Paper/foil/plastic laminate bag,
	Paper/foil/plastic bag	16.180	1540.40	0.0300	46.212	Corrugated paper tray
	Corrugated paper tray	6.910	726.56	0.0221	16.057	
18	TOTAL	24.820	1749.760	0.134	87.460	Paper/foil/plastic laminate bag
	Paper/plastic/foil bag	20.940	1007.52	0.0754	75.967	top gusseted only. 2 paper cups,
	Paper cups	2.220	679.24	0.0127	8.626	1 paperboard backing tray.
	PB cover	1.660	63.00	0.0455	2.867	
19	TOTAL	18.110	1232.79	0.0457	22.865	Paperboard tray, plastic outer wrap.
	PB box	13.990	453.20	0.0391	17.720	
	Plastic outer wrap	4.120	779.59	0.0066	5.145	
20	TOTAL	74.949	2888.24	0.070	106.796	Paperboard box,
	PB box	68.740	1568.04	0.0559	87.653	Plastic/foil laminate inner bag
	Plastic/Foil inner bag	6.209	1320.20	0.0145	19.143	
21	TOTAL	13.600	2608.100	0.262	142.879	Expanded polystyrene tray, plastic
	PS tray	6.830	513.36	0.2450	125.768	outer wrap, 2 adhesive labels
	Plastic wrap	5.380	1984.50	0.0081	16.074	
	Adhesive label	1.390	110.24	0.0094	1.036	
22	TOTAL	23.930	2004.150	0.096	63.413	Polystyrene tray,
	EPS tray	16.340	622.45	0.0910	56.643	Plastic outer wrap
	Plastic outer wrap	7.590	1381.70	0.0049	6.770	
23	TOTAL	1.350	340.800	0.004	1.431	Plastic/foil laminate pouch
	Plastic/foil laminate pouch	1.350	340.80	0.0042	1.431	
24	TOTAL	3.650	488.000	0.037	7.133	Plastic/foil laminate pouch,
	Plastic/foil laminate bag	1.240	323.00	0.0064	2.067	paperboard backing tray.
	PB tray	2.410	165.00	0.0307	5.066	
27	TOTAL	51.920	2368.910	0.138	125.445	Gable-top paperboard box,
	PB box	39.420	1072.26	0.0861	92.322	plastic/foil laminate bag,
	Plastic/foil laminate bag	3.850	710.01	0.0236	16.756	polystyrene tray.
	PS tray	8.650	586.64	0.0279	16.367	
28	TOTAL	95.620	4018.940	0.059	102.637	Paperboard box, 4 plastic inner
	PB box	82.180	1718.46	0.0582	100.014	pouches.
	Plastic bag	13.440	2300.48	0.0011	2.623	
29	TOTAL	22.610	0.000	0.041	77.616	Polystyrene container.
	PS Container	22.610	0.00	0.0412	77.616	

C.11 Cracker Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
30	Crackers	Ritz	340	12	357.94	17.897	20.000	21	16	80
		Nabisco			357.94	17.897	20.000	21		80
					357.94	17.897	20.000	21		80
31	Crackers	Meijers Select	454	16	478.61	19.144	25.000	30	15	60
					478.61	19.144	25.000	30		60
					478.61	19.144	25.000	30		60
32	Crackers	Ritz	454	16	475.35	23.768	20.000	28	16	80
		Nabisco			475.35	23.768	20.000	28		140
					475.35	23.768	20.000	28		140
33	Crackers	Salerno	368	13	387.86	15.514	25.000	25	15	60
					387.86	15.514	25.000	25		60
34	Crackers	Shur-good	340	12	345.95	13.838	25.000	23	15	60
					345.95	13.838	25.000	23		60

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
30	TOTAL	57.170	2780.04	0.051	61.657	Paperboard box,
	PB box	49.190	1172.64	0.0460	53.941	3 plastic bags
	Plastic bags	7.980	1607.40	0.0048	7.716	
31	TOTAL	72.060	4222.340	0.055	84.631	Paperboard box,
	PB box	61.310	1414.34	0.0507	76.005	4 plastic bags
	Plastic bag	10.750	2808.00	0.0047	8.626	
32	TOTAL	75.020	3702.45	0.0593	94.975	Paperboard box,
	PB box	63.370	1559.25	0.0550	85.759	4 plastic bags
	Plastic bags	11.650	2143.20	0.0043	9.216	
33	TOTAL	18.580	1426.500	0.014	19.400	Paper/plastic laminate gusseted bag
	Paper/plastic laminate bag	18.580	1426.50	0.0136	19.400	
34	TOTAL	5.180	1253.000	0.004	4.761	Plastic bag
	Plastic bag	5.180	1253.00	0.0038	4.761	

C.12 Dinner Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
185	Dinners	Mallard's Chicken Stew	737	26	756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
					756	10.32	73.23	3	227	310
186	Dinners	Progresso Pasta	515	18.2	536	8.19	65.48	2.5	203	310
					536	8.19	65.48	2.5	203	310
					536	8.19	65.48	2.5	203	310

191	Dinners	Healthy Choice Chicken	344	12.15	536	8.19	65.48	2.5	203	310
					358	3.33	107.50	1	344	320
					358	3.33	107.50	1	344	320
					358	3.33	107.50	1	344	320
187	Dinners	Kraft Mac & Cheese Dinner	793	28	805	26.29	30.63	8	98	320
					805	26.29	30.63	8	98	320
188	Dinners	Kraft Mac & Cheese	206	7.25	215	7.99	26.92	3	70	260
					215	7.99	26.92	3	70	260
189	Dinners	Kraft Mac & Cheese	420	15	429	15.93	26.92	6	70	260
					429	15.93	26.92	6	70	260
190	Dinners	Kraft Mac & Cheese Deluxe	397	14	411	13.42	30.63	4	98	320
					411	13.42	30.63	4	98	320
192	Dinners	Dinty Moore Chicken Noodle	283	10	295	2.81	104.81	1	283	270
					295	2.81	104.81	1	283	270
					295	2.81	104.81	1	283	270
193	Dinners	Franco-American Mac & Cheese	418	14.5	435	3.45	126.00	2	252	200
					435	3.45	126.00	2	252	200
					435	3.45	126.00	2	252	200

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
185	TOTAL	77.74	4228.55	0.59	330.63	Paperboard outer carton
	PB outer carton	19.69	770.900	0.032	24.823	Polystyrene tray, Paper/plastic
	PS tray	12.59	534.070	0.469	250.692	baking tray. Foil/plastic pouch
	Paper/plastic tray	29.52	588.920	0.064	37.750	Plastic pouch, outer plastic
	Foil/plastic pouch	3.53	504.560	0.007	3.734	wrap
	Outer plastic wrap	1.87	925.120	0.003	2.590	
	Plastic pouch	10.54	904.980	0.012	11.041	
186	TOTAL	21.14	2731.26	0.03	21.79	Outer plastic fin sealed pouch
	Outer plastic pouch	12.54	1422.440	0.008	11.948	Inner plastic pouch
	Inner plastic pouch	4.98	275.650	0.018	4.989	Inner plastic mesh pouch
	Mesh pouch	3.62	1033.170	0.005	4.856	
191	TOTAL	65.97	2215.47	0.08	69.42	Paperboard outer carton
	PB outer carton	36.43	1272.230	0.036	45.800	Plastic film cover with PET
	Plastic film	1.08	438.350	0.002	0.745	tray

	PET Plate	28.46	504.890	0.045	22.872	
187	TOTAL	64.48	1897.26	0.07	80.26	Paperboard outer carton
	PB outer carton	56.88	1350.780	0.054	72.942	Plastic/foil laminate
	Plastic/foil pouch	7.60	546.480	0.013	7.323	pouch
188	TOTAL	24.38	877.37	0.05	27.76	Paperboard outer carton
	PB outer carton	22.21	620.380	0.042	25.808	Plastic/foil/paper laminated
	Plastic/foil/paper pouch	2.17	256.990	0.008	1.953	pouch
189	TOTAL	39.05	1184.09	0.06	42.60	Paperboard outer carton
	PB outer carton	35.17	846.330	0.046	38.677	Plastic/foil/paper laminated
	Plastic/foil/paper pouch	3.88	337.760	0.012	3.918	pouch
190	TOTAL	34.51	949.82	0.07	39.97	Paperboard outer carton
	PB outer carton	30.59	676.240	0.054	36.382	Plastic/foil laminate
	Foil/plastic pouch	3.92	273.580	0.013	3.584	pouch
192	TOTAL	46.86	1132.58	0.14	54.38	Paperboard outer carton
	PB outer carton	26.43	721.870	0.045	32.195	Plastic tray with plastic film
	Plastic film	2.70	172.250	0.013	2.153	cover
	Plastic tray	17.73	238.460	0.084	20.031	
193	TOTAL	56.10	642.78	0.04	15.97	3 piece steel can, paper label
	3 Piece Can	53.76	373.330	0.038	14.112	
	Paper Label	2.34	269.450	0.007	1.859	

C.13 Dish Soap Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Uses per container, one wash basis
Hand						
176	Dish Soap	Pamolive Ultra	1240	42	1268	84.53
					1268	84.53
177	Dish Soap	Pamolive Ultra	434	14.7	444	29.60
					444	29.60
178	Dish Soap	Dawn Ultra	1260	42.7	1278	85.20
					1278	85.20
179	Dish Soap	Dawn Ultra	828	28	836	55.73
					836	55.73
Auto						
			g	oz	g	one wash basis
180	Dish Soap	Cascade Powder	1400	50	1426	25.46
					1426	25.46
181	Dish Soap	Cascade Gel	2400	85	2421	43.23
					2421	43.23

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
Hand						
176	TOTAL	72.65	908.91	0.05	42.54	PET bottle, recloseable cap
	Plastic bottle	72.65	908.910	0.047	42.537	
177	TOTAL	30.77	384.96	0.05	18.44	PET bottle, recloseable cap
	Plastic bottle	30.77	384.960	0.048	18.440	
178	TOTAL	59.79	841.48	0.05	45.19	HDPE bottle, recloseable cap
	Plastic bottle	59.79	841.480	0.054	45.187	
179	TOTAL	46.43	653.46	0.05	35.35	HDPE bottle, recloseable cap
	Plastic bottle	46.43	653.460	0.054	35.352	

Auto										
180	TOTAL	81.60	1054.00	0.08	87.17	Paperboard box with				
	PB box	81.60	1054.000	0.083	87.166	foil/plastic outer coating				
181	TOTAL	124.91	1486.50	0.08	120.70	HDPE plastic bottle				
	Plastic bottle	124.91	1486.500	0.081	120.704					

C.14 Drink Mix Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 240ml basis	Drink Mix, ml prepared	Manufacturer Serving	Serving Size, g	Calories/ Serving
118	Drink Mix	Kool-Aid	538	19	548.05	31.79	7630.47	32	17	60
					548.05	31.79	7630.47	32	17	60
					548.05	31.79	7630.47	32	17	60
119	Drink Mix	Kool-Aid	39.6	1.4	42.72	32.41	7778.00	32	1.3	5
					42.72	32.41	7778.00	32	1.3	5
					42.72	32.41	7778.00	32	1.3	5
120	Drink Mix	Crystal Light	51	1.8	54.31	44.63	10712.19	48	1.2	5
					54.31	44.63	10712.19	48	1.2	5
					54.31	44.63	10712.19	48	1.2	5
					54.31	44.63	10712.19	48	1.2	5
121	Drink Mix	Drink-Aid	538	19	543.89	31.55	7572.55	32	17	60
					543.89	31.55	7572.55	32	17	60
					543.89	31.55	7572.55	32	17	60
					543.89	31.55	7572.55	32	17	60
259	Drink Mix	Kool-Aid	4.5	0.16	4.62	7.59	1822.51	8	0.6	0
					4.62	7.59	1822.51	8	0.6	0
117	Drink Mix	Mott's In a minute	340	11.5	347	5.70	1368.86	6	60	100
					347	5.70	1368.86	6	60	100

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
118	TOTAL	63.22	1045.54	0.09	56.89	HDPE Plastic container with
	Plastic container	61.64	684.550	0.080	54.901	screw-on top. Plastic label on
	Plastic label	1.58	360.990	0.006	1.985	outside
119	TOTAL	22.76	1238.21	0.05	23.75	Paperboard box with 4
	PB box	15.72	404.210	0.044	17.745	plastic/foil/paper laminate
	4 Paper/foil/plastic pouch	7.04	834.000	0.007	6.005	pouches
120	TOTAL	48.01	1334.83	0.14	54.42	Plastic tube with 6 plastic
	Plastic tube	29.89	437.320	0.078	33.892	foil sealed cups. Plastic
	6 Plastic cups	14.58	365.160	0.043	15.519	outer labeling.
	Foil seals	0.40	153.830	0.012	1.907	
	Plastic label	3.14	378.520	0.008	3.104	
121	TOTAL	100.91	1077.26	0.20	52.82	Paperboard tube with metal
	PB cannister	48.17	329.600	0.110	36.256	top and bottom. Paper label
	Metal lid/bottom	43.00	314.000	0.024	7.410	plastic recloseable HDPE lid

	Plastic lid	6.54	104.060	0.062	6.452	
	Paper label	3.20	329.600	0.008	2.703	
259	TOTAL	1.78	208.59	0.01	1.67	Plastic/foil/paper laminate
	Paper/plastic/foil pouch	1.78	208.590	0.008	1.669	pouch
117	TOTAL	15.06	515.22	0.01	6.44	Aluminum can
	Aluminum can	15.06	515.220	0.013	6.440	

C.15 Egg Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
171	Eggs	Eggland's Best	600	21	679	9.506	71.429	12	50	70
					679	9.506	71.429	12	50	70
172	Eggs	Kroger	600	21	689	9.646	71.429	12	50	70
					689	9.646	71.429	12	50	70
174	Eggs	Goff's	1200	42	1247	17.458	71.429	24	50	70
					1247	17.458	71.429	24	50	70
					1247	17.458	71.429	24	50	70
258	Eggs	Kroger	1200	42	1237	17.318	71.429	24	50	70
					1247	17.458	71.429	24	50	70
					1247	17.458	71.429	24	50	70

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
171	TOTAL	15.65	1007.47	0.22	217.41	Expanded polystyrene (EPS)
	Foam carton	15.65	1007.470	0.216	217.412	foam carton.
172	TOTAL	48.50	1161.15	0.10	119.83	Paper molded carton
	Paper carton	48.50	1161.150	0.103	119.831	
174	TOTAL	73.43	2698.84	0.12	190.26	Paper molded carton
	Paper carton	64.98	1624.320	0.113	182.736	Plastic outer wrap
	Plastic wrap	8.45	1074.520	0.007	7.522	
258	TOTAL	33.22	2483.99	0.21	310.11	Expanded polystyrene (EPS)
	Foam carton	24.86	1468.120	0.205	300.965	foam carton. Outer plastic
	Plastic wrap	8.36	1015.870	0.009	9.143	wrap

C.16 Fruit Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
214	Fruit	Sunkist	1810	64	1826	8.30	220.00	11	154	70
					1826	8.30	220.00	11	154	70
					1826	8.30	220.00	11	154	70
215	Fruit	Sunfresh	737	26	749	4.16	180.00	6	126	70
					749	4.16	180.00	6	126	70
					749	4.16	180.00	6	126	70
216	Fruit	Del Monte	425	15	439	2.12	206.67	3.5	124	60
					439	2.12	206.67	3.5	124	60
					439	2.12	206.67	3.5	124	60
217	Fruit	Del Monte	822	29	838	6.60	127.00	6	127	100
					838	6.60	127.00	6	127	100
					838	6.60	127.00	6	127	100
218	Fruit	Del Monte	453	16	467	3.31	141.25	4	113	80

					467	3.31	141.25	4	113	80
					467	3.31	141.25	4	113	80
					467	3.31	141.25	4	113	80
221	Fruit	Sunkist	454	16	454	2.06	220.00	3	154	70
		Fresh			454	2.06	220.00	3	154	70

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
214	TOTAL	7.28	255.83	0.05	5.83	Plastic mesh bag. Plastic label
	Plastic mesh bag	5.38	108.290	0.037	4.028	
	Plastic label	1.90	147.540	0.012	1.800	
215	TOTAL	341.98	404.14	0.34	109.34	Clear glass jar. Metal lug cap
	Clear glass jar	327.05	347.380	0.310	107.723	
	Metal lug cap	14.93	56.760	0.029	1.618	
216	TOTAL	57.88	653.54	0.04	16.32	3 piece steel can. Paper label
	3-piece steel can	54.66	379.580	0.038	14.462	
	paper label	3.22	273.960	0.007	1.863	
217	TOTAL	111.36	1264.02	0.05	32.32	3 piece steel can. Paper label
	3-piece steel can	105.72	734.150	0.039	28.558	
	Paper label	5.64	529.870	0.007	3.762	
218	TOTAL	120.00	1382.83	0.14	79.51	4 3-piece steel cans with paperboard carton. 4 Paper labels on can
	4 3-piece steel cans	103.52	638.550	0.096	61.173	
	PB carton	13.96	464.210	0.035	16.294	
	4 paper label	2.52	280.070	0.007	2.045	
221	TOTAL	2.49	3918.69	0.001	3.13	HDPE plastic bag
	plastic bag	2.49	3918.690	0.001	3.135	

C.17 Gum Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
45	Gum	Bubble Yum	100	3.527	90.95	2.729	33.333	20	5	15
					90.95	2.729	33.333	20		15
					90.95	2.729	33.333	20		15
					90.95	2.729	33.333	20		15
46	Gum	Spartan	85	3	88.85	2.666	33.333	17	5	15
					88.85	2.666	33.333	17		15
					88.85	2.666	33.333	17		15
					88.85	2.666	33.333	17		15
47	Gum	Extra	108	3.78	108.87	2.016	54.000	40	2.7	5
					108.87	2.016	54.000	40		5
					108.87	2.016	54.000	40		5
					108.87	2.016	54.000	40		5
					108.87	2.016	54.000	40		5
					108.87	2.016	54.000	40		5
48	Gum	Doublemint	13.5	0.5	16.1	0.298	54.000	5	2.7	5
					16.1	0.298	54.000	5		5
					16.1	0.298	54.000	5		5
					16.1	0.298	54.000	5		5
134	Gum	Dentyne Ice	18	0.6	16.66	0.278	60.000	6	3	5
					16.66	0.278	60.000	6		5
					16.66	0.278	60.000	6		5

			16.66	0.278	60.000	6	5
Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description	
45	TOTAL	8.870	1103.520	0.020	7.177	Plastic outer wrap	
	Plastic outer wrap	2.280	299.280	0.008	2.364	5 Plastic/foil laminate gum wrappers,	
	Plastic/foil laminate wrapper	3.600	305.440	0.007	2.169	20 Paper gum wrapper,	
	Paper gum wrapper	2.990	498.80	0.0053	2.644	4 packs	
46	TOTAL	8.840	1523.380	0.021	8.185	Plastic outer bag,	
	Plastic bag	1.810	467.28	0.0040	1.869	Paper adhesive label	
	Paper adhesive label	1.870	150.00	0.0119	1.785	17 Paper gum wrappers	
	paper wrapper	5.160	906.10	0.0050	4.531		
47	TOTAL	23.650	4057.200	0.024	22.824	Plastic outer bag,	
	Plastic outer bag	2.850	439.76	0.0051	2.243	adhesive paper label. Plastic/foil	
	Plastic/foil laminate wrapper	6.040	613.04	0.0080	4.904	laminated wrapper, paper wraps	
	Paper wrapper	5.570	1366.80	0.0050	6.834	foil wraps, 8 packs	
	Foil wrapper	9.190	1637.600	0.0054	8.843		
	Paper label	1.000	194.640	0.0099	1.927		
48	TOTAL	2.740	442.300	0.020	2.735	Plastic/foil outer wrapper	
	Plastic/foil outer wrapper	0.700	62.30	0.0087	0.542	5 Paper wrappers,	
	Paper wrapper	0.880	170.85	0.0061	1.042	5 Foil wrappers,	
	Foil wrapper	1.160	209.15	0.0055	1.150	1 pack	
134	TOTAL	5.740	291.140	0.057	6.417	Paperboard sleeve,	
	PB cover	3.200	122.18	0.0306	3.739	Plastic blister pack, foil seal.	
	Plastic blister	1.540	108.96	0.0226	2.462	12 pieces.	
	foil cover	1.000	60.00	0.0036	0.216		

C.18 Hand Soap Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container
Bar						
9	Soap	Dial	250	9	264.65	126.02
					264.65	126.02
					264.65	126.02
10	Soap	Dial	425	15	430.11	204.81
					430.11	204.81
					430.11	204.81
11	Soap	Dial	1400	50	1420.8	676.57
					1420.8	676.57
					1420.8	676.57
					1420.8	676.57
12	Soap	Ivory	254	9	258.84	123.26
					258.84	123.26
					258.84	123.26
14	Soap	Lever 2000	280	10	287.46	136.89
					287.46	136.89
15	Soap	Lava	163	5.75	171.59	81.71
					171.59	81.71

						171.59	81.71
Liquid							
8	Soap	Dial	ml 443	fl oz 15	ml 458	91.60	
					458	91.60	
13	Soap	Dial	221	7.5	224	44.80	
					224	44.80	
					224	44.80	
16	Soap	Softsoap	221	7.5	225	45.00	
					225	45.00	

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Packaging, cm3	Description
Bar						
9	TOTAL	20.38	1471.24	0.05	27.31	Paperboard box with 2 bars
	PB box	19.16	544.870	0.049	26.481	individually plastic wrapped
	2 plastic soap wraps	1.22	926.370	0.001	0.834	soap.
10	TOTAL	8.84	1201.91	0.01	8.36	3 Paper/Plastic laminate
	3 Plastic/paper soap wrap	6.87	683.650	0.010	6.495	soap wraps. Outer
	Plastic/foil outer wrap	1.97	518.260	0.004	1.866	plastic/foil laminate wrap
11	TOTAL	32.87	3564.35	0.04	34.99	10 Paper/plastic laminate
	PB outer card	7.04	265.400	0.031	8.307	soap wraps. Paperboard
	10 Plastic/paper soap wrap	23.50	2403.160	0.010	23.551	backing card. Plastic outer
	Plastic outer wrap	2.33	895.790	0.004	3.135	wrap
12	TOTAL	16.98	1072.03	0.04	22.81	2 paperboard boxes. Plastic
	2 PB box	15.40	578.740	0.036	20.835	outer wrapping
	Plastic outer wrap	1.58	493.290	0.004	1.973	
14	TOTAL	23.39	734.91	0.05	33.22	Paperboard laminate
	PB laminate box	23.39	734.910	0.045	33.218	box. Contains 2 soaps
15	TOTAL	4.84	377.64	0.03	5.24	Paper/plastic outer soap
						wrap.
	Plastic/paper outer wrap	1.61	189.860	0.008	1.462	Paperboard backing
	PB backing	3.23	187.780	0.020	3.774	
Liquid						
8	TOTAL	78.67	692.98	0.07	45.67	PET plastic bottle
	PET bottle	78.67	692.980	0.066	45.667	
13	TOTAL	52.40	850.85	0.12	46.85	Paperboard carton with PET
	PB box	18.22	529.400	0.045	23.929	plastic bottle with plastic
						pump.
	PET bottle	34.18	321.450	0.071	22.919	
16	TOTAL	39.25	345.71	0.07	25.82	PET plastic bottle with
						plastic
	PET bottle	39.25	345.710	0.075	25.825	pump.

C.19 Ice Cream Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
236	Ice Cream	Old Fashioned	2560	90	2578	48.34	53.33	40	64	120
					2578	48.34	53.33	40	64	120
237	Ice Cream	Kroger	1168	42	1175	25.75	45.63	16	73	160

238	Ice Cream	Breyers	1104	39	1175	25.75	45.63	16	73	160
					1125	24.46	46.00	16	69	150
					1125	24.46	46.00	16	69	150
239	Ice Cream	Homemade	1376	48	1125	24.46	46.00	16	69	150
					1389	29.07	47.78	16	86	180
					1389	29.07	47.78	16	86	180
240	Ice Cream	Haagen Dazs	848	30	1389	29.07	47.78	16	86	180
					854	21.75	39.26	8	106	270
					854	21.75	39.26	8	106	270

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
236	TOTAL	78.69	1518.39	0.06	89.59	HDPE plastic tub with lid
	Plastic tub & lid	78.69	1518.390	0.059	89.585	
237	TOTAL	58.64	1675.32	0.04	75.12	Laminated Paperboard container
	PB carton	58.64	1987.360	0.038	75.122	
238	TOTAL	59.96	1356.54	0.07	74.59	Laminated Paperboard container with plastic LDPE lid
	PB carton	52.34	1428.630	0.048	68.574	
	Plastic lid	7.62	231.210	0.026	6.011	
239	TOTAL	61.01	1868.52	0.08	70.74	Laminated Paperboard container with paperboard lid and plastic window.
	PB Tub	51.68	1598.620	0.039	61.867	
	PB lid	8.79	245.100	0.036	8.750	
	Plastic window	0.54	24.800	0.005	0.124	
240	TOTAL	29.13	990.66	0.06	33.98	Laminated Paperboard cup with plastic lid.
	PB Tub	24.63	865.120	0.036	30.971	
	Plastic lid	4.50	125.540	0.024	3.013	

C.20 Juice Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Uses per Container, 240ml basis	Manufacturer Serving	Serving Size, ml	Calories/ Serving
80	Juice	Speas Farm	978	33.07	995	4.146	6	163	80
					995	4.146	6		80
					995	4.146	6		80
81	Juice	Speas Farm	492	16.92	500	2.083	4	125	60
					500	2.083	4		210
					500	2.083	4		210
					500	2.083	4		210
					500	2.083	4		210
82	Juice	Speas Farm	1360	46	1380	5.750	6	227	120
					1380	5.750	6		120
					1380	5.750	6		120
83	Juice	Mott's	750	25.5	740	3.083	3	250	120
					740	3.083	3		120
					740	3.083	3		120
					740	3.083	3		120
					740	3.083	3		120
84	Juice	Minute Maid	2250	76.05	2260	9.417	9	250	120

					2260	9.417	9		120
					2260	9.417	9		120
					2260	9.417	9		120
					2260	9.417	9		120
					2260	9.417	9		120
85	Juice	Mott's	3790	128	3890	16.208	16	236	120
					3890	16.208	16		120
86	Juice	Musselman's	3548	120	3565	14.854	16	221	120
					3565	14.854	16		120
88	Juice	Wilderness	1890	64	1930	8.042	8	236	120
					1930	8.042	8		120
89	Juice	Capri - Sun	2000	67.5	2150	8.958	10	215	100
					2150	8.958	10		100
					2150	8.958	10		100
					2150	8.958	10		100
					2150	8.958	10		100
90	Juice	Minute Maid	355	12	364	5.195	6	60	110
					364	5.195	6		110
					364	5.195	6		110
					364	5.195	6		110
97	Juice	Minute Maid	475	16	490	7.886	8	60	110
					490	7.886	8		110
					490	7.886	8		110
					490	7.886	8		110
91	Juice	Minute Maid	2840	96	2860	11.917	12	236	110
					2860	11.917	12		110
					2860	11.917	12		110
92	Juice	Kroger	3780	127.8	3865	16.104	16	236	100
					3865	16.104	16		100
93	Juice	Kroger	946	32	960	4.000	4	240	110
					960	4.000	4		110
94	Juice	Tropicana	473	16	480	2.000	2	240	110
					480	2.000	2		110
96	Juice	Minute Maid	1890	64	1890	7.875	8	240	110
					1890	7.875	8		110
					1890	7.875	8		110
98	Juice	Tropicana	720	24	760	3.167	3	240	120
					760	3.167	3		120
					760	3.167	3		120
					760	3.167	3		120
					760	3.167	3		120
99	Juice	Minute Maid	1420	48	1500	6.250	6	236	110
					1500	6.250	6		110
					1500	6.250	6		110
					1500	6.250	6		110
					1500	6.250	6		110
					1500	6.250	6		110

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
80	TOTAL	185.080	1421.510	0.0708	44.320	6 3-piece steel cans
	Can	181.960	1377.62	0.0309	42.568	Plastic ring holder
	Plastic can ring holder	3.120	43.89	0.0399	1.751	
81	TOTAL	32.330	1528.050	0.0721	37.272	4 Paper/plastic/foil laminated tetra-pak boxes. Plastic outer wrap.
	Paper/foil box	27.870	788.48	0.0434	34.220	Plastic straw wrap.
	Plastic outer wrap	1.870	506.00	0.0019	0.961	
	straw plastic wrap	0.890	163.20	0.0022	0.359	
	straw	1.700	70.37	0.0246	1.731	
82	TOTAL	164.388	1293.070	0.046	34.493	3-piece steel can
	Can	159.290	842.06	0.0355	29.893	Paper label
	Paper Label	5.098	451.01	0.0102	4.600	
83	TOTAL	37.790	1846.380	0.0659	44.168	3 Paper/plastic/foil laminated drink boxes. Plastic outer wrap.
	Paper/foil box	33.290	1029.56	0.0380	39.123	Straw, straw plastic wrap
	outer plastic wrap	2.310	595.65	0.0018	1.072	
	straw wrap	0.750	159.72	0.0241	3.849	
	straw	1.440	61.45	0.0020	0.123	
84	TOTAL	88.330	5396.610	0.1138	177.964	9 Paper/plastic/foil laminated drink box, plastic outer wrap. Paperboard outer label, straws, straw wrap
	Paper/foil box	67.150	2955.96	0.0520	153.710	
	outer plastic wrap	3.280	1339.80	0.0034	4.555	
	PB backing	11.250	443.00	0.0330	14.619	
	straw	4.670	178.69	0.0236	4.217	
	straw wrap	1.980	479.16	0.0018	0.862	
85	TOTAL	173.030	3274.670	0.0413	135.244	PET plastic with recloseable lid
	Plastic bottle	173.030	3274.67	0.0413	135.244	
86	TOTAL	155.140	1756.380	0.1158	203.389	HDPE plastic recloseable bottle
	Plastic bottle	155.140	1756.38	0.1158	203.389	
88	TOTAL	640.770	0.000	0.0000	310.460	Clear glass bottle
	Clear glass bottle	640.770	0.00	0.0000	310.460	
89	TOTAL	200.800	5809.940	0.3765	649.956	10 plastic/foil laminated pouches. Corrugated box, straws and plastic straw wrappers.
	Corrugated Box	134.560	1842.33	0.3255	599.678	
	Aluminum/plastic pouch	56.200	3410.40	0.0130	44.335	
	straw plastic outer wrap	2.150	414.40	0.0019	0.787	
	straw	7.890	142.81	0.0361	5.155	
90	TOTAL	28.430	339.440	0.154	21.884	Paperboard tube with aluminum top and bottom closures. Plastic seal around top closure.
	Paper Board Tube	11.980	249.26	0.0708	17.648	
	Metal top/bottom	15.880	72.63	0.0505	3.668	
	Plastic seal	0.570	17.55	0.0324	0.569	
97	TOTAL	34.860	417.190	0.145	24.634	Paperboard tube, aluminum top and bottom closures. Plastic seal around top closure
	Paper board tube	18.150	329.13	0.0623	20.505	
	Metal top/bottom	16.140	70.51	0.0505	3.561	
	Plastic seal	0.570	17.55	0.0324	0.569	
91	TOTAL	101.540	1580.035	0.113	129.390	Plastic bottle, foil seal,

	Plastic bottle	101.220	1516.45	0.0841	127.533	plastic cap
	foil seal	0.320	63.59	0.0292	1.857	
92	TOTAL	69.790	1759.130	0.040	70.365	Plastic HDPE gallon jug
	HDPE gallon jug	69.790	1759.13	0.0400	70.365	
93	TOTAL	38.150	761.600	0.053	40.060	Gable-top paperboard carton
	PB gable top carton	38.150	761.60	0.0526	40.060	
94	TOTAL	24.520	487.900	0.056	27.225	Gable-top paperboard carton
	PB gable top carton	24.520	487.90	0.0558	27.225	
96	TOTAL	83.180	1302.210	0.242	89.878	Gable-top paperboard carton,
	PB gable top carton	80.030	1255.64	0.0650	81.617	plastic spout, plastic cap.
	Plastic spout/closure	3.150	46.57	0.1774	8.262	
98	TOTAL	69.040	1748.620	0.126	80.684	Paperboard holder, 3 gable-top
	PB holder	21.160	628.23	0.0420	26.386	paperboard cartons. Plastic
						straw
	PB carton	42.960	957.63	0.0544	52.095	wrap and 3 straws
	straw wrap	3.000	90.90	0.0040	0.364	
	straws	1.920	71.86	0.0256	1.840	
99	TOTAL	148.030	2604.240	0.065	187.652	6 plastic HDPE bottles, plastic
	Plastic bottle	94.300	0.00	0.0000	163.600	labels, foil seals, recloseable
	PB outer wrap	10.700	401.98	0.0311	12.502	plastic HDPE lids. Paperboard
	plastic label	23.040	1023.84	0.0044	4.505	label, plastic outer wrap.
	foil seal	3.770	68.42	0.0251	1.717	
	Plastic outer wrap	16.220	1110.00	0.0048	5.328	

C.21 Laundry Detergent Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Standard Uses, washes per container	Manufacturer wash per container	Use Amount, ml
Liquid								
110	Laundry Detergent	Tide	1470	50	1490	12.31	12	121
					1490	12.31	12	
111	Laundry Detergent	Tide	5910	200	5922	48.94	48	121
					5922	48.94	48	
112	Laundry Detergent	Tide	2660	90	2698	22.30	22	121
					2698	22.30	22	
Powder								
			g	oz	g			g
113	Laundry Detergent	Tide	5270	186	5286.27	85.26	85	62
					5286.27	85.26	85	
					5286.27	85.26	85	
114	Laundry Detergent	Tide	620	22	703.19	11.34	10	62
					703.19	11.34	10	
115	Laundry Detergent	Tide	4020	142	4079.2	65.79	65	62
					4079.2	65.79	65	
116	Laundry Detergent	Tide	1100	39	1166.07	18.81	18	62
					1166.07	18.81	18	

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
Liquid						
110	TOTAL	231.87	0.00	0.00	147.25	HDPE plastic bottle with cap
	Plastic bottle/cap	231.87	0.000	0.000	147.250	
111	TOTAL	396.91	0.00	0.00	318.23	HDPE plastic bottle with cap
	Plastic bottle/cap	396.91	0.000	0.000	318.230	
112	TOTAL	121.42	0.00	0.00	194.04	HDPE plastic bottle with cap
	Plastic bottle/cap	121.42	0.000	0.000	194.040	
Powder						
113	TOTAL	401.69	4971.63	0.21	462.72	Paperboard box with plastic strap
	PB box	396.22	4871.230	0.093	450.589	
	Plastic strap	5.47	100.400	0.121	12.128	
114	TOTAL	71.75	1373.37	0.06	80.75	Paperboard box
	PB box	71.75	1373.370	0.059	80.754	
115	TOTAL	28.11	2252.88	0.01	26.36	Plastic bag
	Plastic bag	28.11	2252.880	0.012	26.359	
116	TOTAL	102.85	1914.10	0.08	147.77	Paperboard box
	PB box	102.85	1914.100	0.077	147.769	

C.22 Lunch Meat Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
157	Lunch Meat	West Virginia Brand	284	10	296	4.229	70	10	28	40
158	Lunch Meat	Hillshire Farms	170	6	179	1.884	95	3	57	60
					179	1.884	95	3	57	60
159	Lunch Meat	Sara Lee	198	7	207	2.112	98	4	49	50
160	Lunch Meat	Russer	245	8	245	3.063	80	10	56	70
					245	3.063	80	10	56	70
					245	3.063	80	10	56	70

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
157	TOTAL	4.38	423.44	0.01	3.73	Plastic sealed pouch LDPE
	Plastic Pouch	4.38	423.440	0.009	3.726	
158	TOTAL	19.71	911.00	0.04	20.65	Paperboard outer carton, inner plastic 4-sided sealed pouch
	PB box	15.59	502.400	0.036	18.036	
	Plastic Pouch	4.12	408.600	0.006	2.615	
159	TOTAL	9.05	668.30	0.01	5.61	Plastic recloseable pouch
	Plastic Pouch	9.05	668.300	0.008	5.614	
160	TOTAL	5.64	1666.14	0.01	6.37	LDPE recloseable bag
	LDPE bag	4.94	1122.100	0.005	5.611	Plastic inner wrapping
	Plastic wrapping	0.70	544.040	0.001	0.762	

C.23 Margarine Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Manufacturer Serving	Serving Size, g	Calories/ Serving
167	Margarine	Fleischman's	454	16	465	32	14	40
					465	32	14	40
					465	32	14	40
					465	32	14	40
168	Margarine	Promise Light	453	16	462	32	14	50
					462	32	14	50
					462	32	14	50
					462	32	14	50
169	Margarine	Fleischman's Squeeazble	340	12	343	23	15	5
					343	23	15	5
					343	23	15	5
					343	23	15	5
170	Margarine	Fleishman's	907	32	916	60	15	45
					916	60	15	45
					916	60	15	45
					916	60	15	45
257	Margarine	Spartan	453	16	459	32	14	100
					459	32	14	100
					459	32	14	100
					459	32	14	100

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
167	TOTAL	45.09	1289.35	0.13	55.50	Paperboard carton with 2
	PB carton	18.43	584.000	0.039	22.951	Polypropylene cups. 2
	2 Plastic cups	14.72	461.620	0.043	19.757	recloseable plastic lids
	2 Plastic lids	11.94	243.730	0.053	12.796	
168	TOTAL	23.08	1465.72	0.04	25.41	Paperboard carton with 4
	PB carton	14.92	597.400	0.031	18.460	aluminum foil wrappers
	4 Aluminum wrapper	8.16	868.320	0.008	6.947	
	TOTAL	41.48	798.56	0.07	39.55	HDPE bottle with foil seal
169	Plastic bottle	40.96	793.250	0.050	39.425	
	foil seal	0.52	5.310	0.024	0.127	
	TOTAL	39.09	799.03	0.14	57.29	HDPE tub with LDPE plastic
	Plastic tub	37.49	537.960	0.075	40.239	lid
170	Plastic lid	1.60	261.070	0.065	17.048	
	TOTAL	20.81	1628.31	0.04	25.10	Paperboard carton with 4
	PB carton	15.93	645.570	0.030	19.303	paper wrappers
	4 Paper wrappers	4.88	982.740	0.006	5.798	

C.24 Meat Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
198	Meat	Goff's	966	34	968	16.28	59.47	8	113	190
					968	16.28	59.47	8	113	190
					968	16.28	59.47	8	113	190
					968	16.28	59.47	8	113	190
199	Meat	Goff's	494	17.5	501	8.42	59.47	4	113	190
					501	8.42	59.47	4	113	190
					501	8.42	59.47	4	113	190
					501	8.42	59.47	4	113	190
200	Meat	Goff's	1266	44.7	1271	30.37	41.85	9	113	270
					1271	30.37	41.85	9	113	270
					1271	30.37	41.85	9	113	270

201	Meat	Goff's	639	22.5	642	15.34	41.85	5	113	270
					642	15.34	41.85	5	113	270
					642	15.34	41.85	5	113	270

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
198	TOTAL	26.60	2044.99	0.29	219.96	Plastic film laminated
	PS tray	17.21	756.360	0.280	211.630	expanded polystyrene (EPS)
	Paper backing	1.70	262.510	0.007	1.864	tray. Plastic film seal.
	Plastic barrier layer	7.69	1026.120	0.006	6.465	
199	TOTAL	17.09	1357.26	0.29	135.11	Plastic film laminated
	PS tray	10.52	462.340	0.280	129.363	expanded polystyrene (EPS)
	Paper backing	0.87	134.340	0.007	0.954	tray. Plastic film seal.
	Plastic barrier layer	5.70	760.580	0.006	4.792	
200	TOTAL	11.11	3300.65	0.36	120.08	Expanded polystyrene tray,
	PS tray	5.02	317.550	0.360	114.413	plastic outer wrap.
	Plastic wrap	6.09	2983.100	0.002	5.668	
201	TOTAL	8.13	2591.72	0.36	78.83	Expanded polystyrene tray,
	PS tray	3.26	206.220	0.360	74.301	plastic outer wrap.
	Plastic wrap	4.87	2385.500	0.002	4.532	

C.25 Milk Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
162	Milk	Springdale	3780	128	3795	12.65	300.00	16	240	80
					3795	12.65	300.00	16	240	80
163	Milk	Kroger	1890	64	1946	6.49	300.00	8	240	80
					1946	6.49	300.00	8	240	80
164	Milk	Kroger	946	32	957	3.19	300.00	4	240	80
					957	3.19	300.00	4	240	80
165	Milk	Melody Farms	236	8	240	0.80	300.00	1	240	80
					240	0.80	300.00	1	240	80
166	Milk	Melody Farms	473	16	480	2.40	200.00	2	240	120
					480	2.40	200.00	2	240	120
161	Milk	Springdale	1890	64	1920	6.40	300.00	8	240	80
					1920	6.40	300.00	8	240	80
251	Milk	Deans	946	32	953	3.57	266.67	4	240	90
					953	3.57	266.67	4	240	90
					953	3.57	266.67	4	240	90
252	Milk	Deans	1400	48	1432	7.76	184.62	6	240	130
					1432	7.76	184.62	6	240	130
					1432	7.76	184.62	6	240	130
					1432	7.76	184.62	6	240	130
260	Milk	Quality Dairy	1890	64	1898	9.49	200.00	8	240	120
					1898	9.49	200.00	8	240	120

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
162	TOTAL	67.47	0.00	0.00	70.25	HDPE plastic jug
	Plastic Jug	67.47	0.000	0.000	70.250	gallon
163	TOTAL	63.34	1293.94	0.06	81.52	Paperboard laminated
	PB laminated carton	63.34	1293.940	0.063	81.518	gable top container
164	TOTAL	33.66	882.21	0.05	44.29	Paperboard laminated
	PB laminated carton	33.66	882.210	0.050	44.287	gable top container
165	TOTAL	14.91	221.45	0.04	9.43	Paperboard laminated
	PB laminated carton	14.91	221.450	0.043	9.434	gable top container
166	TOTAL	30.81	533.12	0.05	25.00	PET bottle
	Plastic bottle	30.81	533.120	0.047	25.003	
161	TOTAL	35.23	0.00	0.00	42.15	HDPE plastic jug
	Plastic jug	35.23	0.000	0.000	42.150	1/2 gallon
251	TOTAL	53.52	1483.98	0.05	47.05	HDPE plastic bottle.
	HDPE plastic bottle	49.32	934.910	0.047	44.034	Plastic shrinkwrap label
	Plastic label	4.20	549.070	0.006	3.020	
252	TOTAL	136.61	4486.59	0.06	128.89	6 HDPE plastic bottle.
	6 HDPE plastic bottle	123.90	2315.390	0.050	115.075	6 Plastic shrinkwrap label
	6 Plastic label	5.72	760.740	0.005	3.804	Plastic outer wrap
	Plastic outer wrap	6.99	1410.460	0.007	10.014	
260	TOTAL	12.40	1379.46	0.01	12.97	LDPE plastic pouch
	LDPE plastic pouch	12.40	1379.460	0.009	12.967	

C.26 Paper Towel Product Group

Product Number	Product Category	Brand Name	Label size one square, cm2	Label size one square, in2	Measured size one square, cm2	Uses per container, 1 ft2 basis	Manufacturer Sheet per container
182	Paper Towel	Bounty Quilted	778.41	121	779.86	161.18	192
		3 rolls			779.86	161.18	192
183	Paper Towel	Bounty Select a Size	424.08	66	424.87	80.49	176
		1 roll			424.87	80.49	176
184	Paper Towel	Bounty Quilted	778.41	121	779.35	429.52	512
		8 rolls			779.35	429.52	512
					779.35	429.52	512

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
182	TOTAL	12.46	3998.79	0.003	13.60	3 Paper towel rolls. LDPE
	Outer plastic wrap	12.46	3998.79	0.003	13.596	plastic outer wrap
183	TOTAL	6.22	2400.79	0.003	6.48	1 Paper towel roll. LDPE
	Outer plastic wrap	6.22	2400.79	0.003	6.482	plastic outer wrap
184	TOTAL	77.43	24125.70	0.01	82.97	8 Paper towel rolls. LDPE
	Outer plastic wrap	37.91	8091.87	0.005	42.887	plastic outer wrap.
	Individual plastic roll wrap	39.52	16033.83	0.003	40.085	Individual LDPE plastic roll wraps.

C.27 Pasta Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 100 cal basis	Serving size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
50	Pasta	Contandina	227	8	223.11	8.220	27.143	4	57	210
					223.11	8.220	27.143	4		210
					223.11	8.220	27.143	4		210
51	Pasta	La Molisana	454	16	451.4	16.415	27.500	8	55	200
					451.4	16.415	27.500	8		200
52	Pasta	San Giorgio	454	16	454.46	17.042	26.667	8	56	210
					454.46	17.042	26.667	8		210
					454.46	17.042	26.667	8		210
53	Pasta	Racconto	454	16	457.73	17.165	26.667	8	56	210
					457.73	17.165	26.667	8		210
					457.73	17.165	26.667	8		210
54	Pasta	Noma Morelli	255	9	268.71	7.271	36.957	3	85	230
					268.71	7.271	36.957	3		230
					268.71	7.271	36.957	3		230
55	Pasta	Dell-Alpe	227	8	221.05	8.842	25.000	4	55	220
					221.05	8.842	25.000	4		220
56	Pasta	Antolma	907	32	910.35	33.539	27.143	16	57	210
					910.35	33.539	27.143	16		210
57	Pasta	Pastamania	227	8	237.26	8.325	28.500	4	57	200
					237.26	8.325	28.500	4		200
					237.26	8.325	28.500	4		200
58	Pasta	Al dente	340	12	344.29	12.911	26.667	6	56	210
					344.29	12.911	26.667	6		210
					344.29	12.911	26.667	6		210

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
50	TOTAL	23.900	664.76	0.051	29.632	Paperboard box,
	PB box	23.050	609.26	0.0484	29.488	plastic window
	Plastic window	0.850	55.50	0.0026	0.144	
51	TOTAL	7.940	1495.680	0.006	76.005	Plastic pillow pouch with vertical fin
	Plastic Bag	7.940	1495.68	0.0057	76.005	back seal
52	TOTAL	28.085	760.78	0.0514	34.186	Paperboard box, plastic window
	PB box	26.850	695.78	0.0489	34.024	
	Plastic window	1.235	65.00	0.0025	0.163	
53	TOTAL	3.520	642.000	0.006	3.916	Plastic pillow pouch with vertical fin
	Plastic pouch	3.520	642.00	0.0061	3.916	back seal.
54	TOTAL	25.140	725.520	0.049	18.948	Plastic tray, plastic film top seal.
	Plastic tray bottom	20.010	431.52	0.0341	14.715	
	Plastic film	5.130	294.00	0.0144	4.234	
55	TOTAL	17.170	1363.480	0.011	15.271	Paper/plastic laminate gusseted bag
	Paper/plastic laminate bag	17.170	1363.48	0.0112	15.271	
56	TOTAL	4.880	886.650	0.011	9.310	Plastic bag with vertical fin back seal
	Plastic bag	4.880	886.65	0.0105	9.310	
57	TOTAL	15.450	1274.800	0.571	250.549	Expanded polystyrene (EPS) tray,

	PS tray	10.600	433.34	0.5642	244.490	plastic outer wrap.
	Plastic film covering	4.850	841.46	0.0072	6.059	
58	TOTAL	10.960	2009.530	0.012	9.290	Plastic bag, adhesive paper label,
	Plastic Bag	9.840	1572.10	0.0036	5.660	adhesive paper seal.
	Adhesive label	1.120	437.43	0.0083	3.631	Bag bunched and sealed at top.

C.28 Pet Food Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 1 feeding basis
60	Pet Food	Friskies	368	13	369.85	2.39
					369.85	2.39
					369.85	2.39
61	Pet Food	9 Lives	156	5.5	154.91	1.00
					154.91	1.00
					154.91	1.00
64	Pet Food	Fancy Feast	85	3	86.25	0.56
					86.25	0.56
					86.25	0.56
65	Pet Food	Sheba	100	3.5	98.96	0.64
					98.96	0.64
					98.96	0.64
59	Pet Food	Purina	1020.6	36	1037.03	16.83
					1037.03	16.83
62	Pet Food	Cat Chow	510	18	515.17	8.36
					515.17	8.36
63	Pet Food	9 Lives Plus Care	1587.6	56	1601.43	26.00
					1601.43	26.00
66	Pet Food	Cat Chow	8160	288	8231.35	133.63
					8231.35	133.63
67	Pet Food	Spartan	340	12	343.67	5.58
					343.67	5.58
					343.67	5.58

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
60	TOTAL	54.11	630.59	0.04	12.37	3 piece steel can. Paper label
	3-Piece steel Can	52.06	380.010	0.026	9.766	
	Paper Label	2.05	250.580	0.010	2.606	
61	TOTAL	35.14	343.08	0.03	5.24	2 piece steel can. Paper label
	2-Piece steel Can	34.45	259.690	0.017	4.519	
	Paper Label	0.68	83.390	0.009	0.717	
64	TOTAL	9.80	229.08	0.03	4.22	2 piece steel can. Paper label
	2-Piece steel Can	9.30	174.170	0.021	3.727	
	Paper Label	0.49	54.910	0.009	0.494	
65	TOTAL	9.19	180.11	0.10	9.81	Plastic tray with plastic/foil seal
	Plastic tray	7.17	112.080	0.073	8.137	
	Plastic/foil laminate seal	2.02	68.030	0.025	1.674	
59	TOTAL	100.48	983.99	0.11	112.08	Plastic HDPE container, plastic screw on lid
	HDPE plastic container	100.48	983.990	0.114	112.076	
62	TOTAL	72.56	1334.57	0.06	85.41	Paperboard box
	PB box	72.56	1334.570	0.064	85.412	
63	TOTAL	36.12	2166.44	0.02	40.30	Paper/plastic laminate bag
	Paper/plastic laminate bag	36.12	2166.440	0.019	40.296	
66	TOTAL	182.98	6127.50	0.09	571.70	Multi-wall paper bag,

67	Multi-wall paper bag	182.98	6127.500	0.093	571.696	plastic liner.
	TOTAL	45.21	2901.42	0.05	57.78	Paperboard box, 6
	PB box	41.10	1075.340	0.048	51.939	plastic pouches
	6 Plastic pouches	4.11	1826.080	0.003	5.843	

C.29 Poultry Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
202	Poultry	Case Farms	1687	59	1691	26.86	62.96	19	85	135
					1691	26.86	62.96	19	85	135
203	Poultry	Case Farms	2077	73.2	2077	32.99	62.96	24	85	135
					2077	32.99	62.96	24	85	135
					2077	32.99	62.96	24	85	135
					2077	32.99	62.96	24	85	135

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
202	TOTAL	5.87	1439.10	0.00	6.62	LDPE bag.
	LDPE bag	5.87	1439.100	0.005	6.620	
203	TOTAL	34.64	5006.00	0.45	281.59	Expanded polystyrene tray,
	PS tray	20.32	616.870	0.433	267.351	plastic label. Plastic outer
	Plastic label	0.95	77.610	0.011	0.877	wrap
	Plastic wrap	13.37	4311.520	0.003	13.366	

C.30 Seafood Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
241	Tuna Fish	Star Kist	170	6	178	3.02	58.95	2.5	56	95
					178	3.02	58.95	2.5	56	95
					178	3.02	58.95	2.5	56	95
242	Tuna Fish	Star Kist	234	8.25	256	2.69	95.00	3	76	80
					256	2.69	95.00	3	76	80
					256	2.69	95.00	3	76	80
					256	2.69	95.00	3	76	80
255	Tuna Fish	Star Kist	340	12	348	3.73	93.33	5	56	60
					348	3.73	93.33	5	56	60
					348	3.73	93.33	5	56	60
256	Tuna Fish	Star Kist	234	8.25	253	2.66	95.00	3	76	80
					253	2.66	95.00	3	76	80
					253	2.66	95.00	3	76	80
					253	2.66	95.00	3	76	80
					253	2.66	95.00	3	76	80

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
241	TOTAL	32.13	368.52	0.04	7.55	2 piece steel can with paper label
	2-piece can	29.68	198.780	0.032	6.361	
	paper label	2.45	169.740	0.007	1.188	
242	TOTAL	89.72	785.83	0.06	16.80	Paperboard carton with
	3 2-piece cans	73.71	597.730	0.020	11.775	3 2-piece steel cans with pull tab lid. 3 paper labels
	paper label	1.36	42.120	0.009	0.358	
	PB carton	14.65	145.980	0.032	4.671	
255	TOTAL	53.57	459.14	0.03	8.65	2 piece steel can with paper label
	2-piece can	52.36	318.160	0.024	7.636	
	paper label	1.21	140.980	0.007	1.015	
256	TOTAL	143.83	2823.20	0.11	81.25	3 2-piece steel cans with pull tab lid. 3 paper labels
	3 2-piece cans	73.83	604.210	0.022	13.293	3 PET plastic containers
	PB carton	24.37	808.840	0.038	30.655	Paperboard carton
	PET container	42.25	1049.180	0.034	35.462	3 plastic seals
	paper label	1.35	43.180	0.008	0.345	
	Plastic seal	2.03	317.790	0.005	1.494	

C.31 Shampoo Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Uses per container	Manufacturer Uses per container	Use Amount, ml
232	Shampoo	Pert Plus	443	15	456	45.60	76	6
					456	45.60	76	6
233	Shampoo	Suave	444	15	457	45.70	74	6
					457	45.70	74	6
234	Shampoo	Head & Shoulders	200	6.8	212	21.20	33	6
					212	21.20	33	6
235	Shampoo	Pert Plus	59	2	65	6.50	10	6
					65	6.50	10	6

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
232	TOTAL	47.09	539.64	0.08	42.47	HDPE container
	Plastic container	47.09	539.640	0.079	42.470	
233	TOTAL	37.07	784.36	0.04	28.63	PET container
	Plastic container	37.07	784.360	0.037	28.629	
234	TOTAL	32.52	345.32	0.11	39.30	HDPE container
	Plastic container	32.52	345.320	0.114	39.297	
235	TOTAL	10.50	158.62	0.07	11.09	HDPE container
	Plastic container	10.50	158.620	0.070	11.088	

C.32 Soft Drink Product Group

Product Number	Product Category	Brand Name	Label Weight, ml	Label Weight, fl oz	Measured Weight, ml	Uses per Container, 240ml basis	Manufacturer Serving	Serving Size, ml	Calories/ Serving
135	Soft Drinks	Coca Cola	8517	288	8568	35.70	24	355	*
					8568	35.70	24	355	
					8568	35.70	24	355	
136	Soft Drinks	Coca Cola	3546	120	3555	14.81	6	590	*
					3555	14.81	6	590	
					3555	14.81	6	590	
137	Soft Drinks	IBC	945	32	948	3.95	4	240	110
					948	3.95	4	240	
					948	3.95	4	240	
138	Soft Drinks	Faygo	3000	100	3100	12.92	13	240	120
					3100	12.92	13	240	
139	Soft Drinks	Dr. Pepper	2130	72	2195	9.15	6	355	150
					2195	9.15	6	355	
					2195	9.15	6	355	
140	Soft Drinks	Meijer	4260	144	4320	18.00	12	355	*
				4320	18.00	12	355		
					4320	18.00	12	355	
141	Soft Drinks	Pepsi	2000	67	2040	8.50	8	240	*
					2040	8.50	8	240	
142	Soft Drinks	Coca-Cola	1420	48	1448	6.03	6	237	*
					1448	6.03	6	237	
					1448	6.03	6	237	
143	Soft Drinks	Sprite	591	20	600	2.50	1	591	100
					600	2.50	1	591	
144	Soft Drinks	Coca-Cola	4260	144	4308	17.95	12	355	140
					4308	17.95	12	355	
					4308	17.95	12	355	

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
135	TOTAL	557.06	16058.13	0.07	384.27	Paperboard box, 24
	PB box	200.90	4087.210	0.062	252.590	aluminum cans
	24 Aluminum cans	356.16	11970.920	0.011	131.680	
136	TOTAL	179.50	5160.18	0.06	133.97	6 PET plastic bottle,
	6 Plastic bottle	172.92	5057.620	0.026	130.487	plastic ring holder
	Plastic ring holder	6.58	102.560	0.034	3.487	
137	TOTAL	468.03	0.00	0.00	206.40	Brown glass bottle,
	Brown glass bottle	465.18	0.000	0.000	206.400	recloseable plastic cap
	Plastic closure	2.85	0.000	0.000	0.000	
138	TOTAL	83.45	2440.77	0.03	68.34	Plastic PET bottle
	Plastic bottle	83.45	2440.770	0.028	68.342	
139	TOTAL	95.16	3154.27	0.04	40.76	6 Aluminum cans,

	6 Aluminum can	91.44	3073.400	0.013	38.418	plastic ring holder
	Plastic ring holder	3.72	80.870	0.029	2.345	
140	TOTAL	200.36	7604.42	0.03	96.24	12 aluminum cans,
	12 Aluminum can	181.56	6102.430	0.012	75.060	plastic outer wrap
	Plastic outer wrap	18.80	1501.990	0.014	21.178	
141	TOTAL	57.26	1674.76	0.03	44.21	Plastic PET bottle
	Plastic bottle	57.26	1674.760	0.026	44.214	
142	TOTAL	1396.78	1394.42	0.04	841.27	6 clear glass bottles
	Clear glass bottle	1348.14			779.920	Paperboard carton
	PB carton	48.64	1394.420	0.044	61.354	
143	TOTAL	31.33	916.35	0.03	23.28	PET plastic bottle, plastic
	Plastic bottle	31.33	916.350	0.025	23.275	cap
144	TOTAL	305.99	9748.79	0.06	190.74	12 aluminum cans,
	12 Aluminum cans	218.28	7336.630	0.011	83.638	paperboard box
	PB box	87.71	2412.160	0.044	107.100	

C.33 Soup Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
204	Soup	Lipton Cup-a-Soup	53.8	1.9	58.76	0.61	95.56	4	43	45
					58.76	0.61	95.56	4	43	45
					58.76	0.61	95.56	4	43	45
205	Soup	Lipton Soup Secrets	124	4.4	131.58	4.67	28.18	4	31	110
					131.58	4.67	28.18	4	31	110
206	Soup	Fantastic Foods	43	1.5	49	1.71	28.67	1	43	150
					49	1.71	28.67	1	43	150
					49	1.71	28.67	1	43	150
207	Soup	Campbell's Frozen	938	33.1	958	9.01	106.36	8	117	110
					958	9.01	106.36	8	117	110
					958	9.01	106.36	8	117	110
					958	9.01	106.36	8	117	110
208	Soup	Campbell's	298	10.5	308	2.07	148.75	2.5	119	80
					308	2.07	148.75	2.5	119	80
					308	2.07	148.75	2.5	119	80
209	Soup	Campbell's Chunky	539	19	549	2.65	207.31	2	269.5	130
					549	2.65	207.31	2	269.5	130
					549	2.65	207.31	2	269.5	130
210	Soup	Campells	680	24	695	3.38	205.45	3	226	110
					695	3.38	205.45	3	226	110
					695	3.38	205.45	3	226	110

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
204	TOTAL	23.61	1348.96	0.05	26.08	PB box, 4 plastic/foil/
	PB box	15.33	462.120	0.041	18.716	paper laminate pouches
	4 Paper/foil/plastic pouch	8.28	886.840	0.008	7.361	
205	TOTAL	7.82	589.54	0.01	7.19	Paper/foil/plastic laminate
	Paper/foil/plastic pouch	7.82	589.540	0.012	7.192	pouch.
206	TOTAL	12.32	395.16	0.06	16.12	Paperboard cup, plastic/
	PB cup	11.45	326.080	0.047	15.358	paper laminate seal.
	Paper/plastic seal	0.87	69.080	0.011	0.760	
207	TOTAL	84.72	2720.57	0.10	111.05	Paperboard box, 2 HDPE
	PB box	53.42	1512.920	0.052	78.067	plastic trays. Plastic film
	HDPE tray	29.74	764.500	0.041	31.650	cover over trays.
	Plastic film seal	1.56	443.150	0.003	1.329	
208	TOTAL	39.64	531.94	0.05	17.10	2 piece steel can, paper
	2-piece steel can	37.79	338.530	0.046	15.437	label.
	Paper label	1.85	193.410	0.009	1.663	
209	TOTAL	72.49	828.85	0.05	20.95	3 piece steel can, paper label
	3-piece steel can	69.32	481.400	0.038	18.486	
	Paper label	3.17	347.450	0.007	2.467	
210	TOTAL	315.53	372.88	0.34	101.25	Clear glass jar with metal lug
	Clear glass jar	301.76	320.510	0.311	99.775	cap.
	metal lug cap	13.77	52.370	0.028	1.472	

C.34 Tissue Product Group

Product Number	Product Category	Brand Name	Label size one tissue cm2	Label size one tissue, in2	Measured size one tissue, cm2	Measured size one tissue, in2	Uses per container, 1ft2 basis	Manufacturer Uses per container
122	Tissue	Kleenex Pocket Pack	457.8	70.96	479.3	74.29	61.91	120
					479.3	74.29	61.91	120
					479.3	74.29	61.91	120
123	Tissue	Kleenex Cold Care	445.17	69	461.1	71.47	29.28	59
					461.1	71.47	29.28	59
					461.1	71.47	29.28	59
124	Tissue	Kleenex	464.3	71.9	482.56	74.80	54.02	104
					482.56	74.80	54.02	104
					482.56	74.80	54.02	104
125	Tissue	Kleenex Travelers	447.3	69.33	463.25	71.80	59.84	120
					463.25	71.80	59.84	120
					463.25	71.80	59.84	120
126	Tissue	Kleenex Family Pack	464.34	71.97	487.36	75.54	92.33	176
					487.36	75.54	92.33	176
					487.36	75.54	92.33	176
127	Tissue	Puffs Travel Tissues	476.13	73.8	491.23	76.14	38.07	72
					491.23	76.14	38.07	72
					491.23	76.14	38.07	72

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
122	TOTAL	29.17	2444.40	0.01	8.01	8 Individually wrapped tissue packs. Plastic outer wrap.
	8 plastic tissue wraps	21.22	1568.040	0.004	5.645	
	Outer plastic wrap	7.95	876.360	0.003	2.366	
123	TOTAL	42.12	1469.12	0.07	53.33	Paperboard box, plastic window in box. Plastic adhesive label over plastic window
	PB box	40.47	1008.320	0.050	50.819	
	Plastic wrap	0.87	358.080	0.004	1.361	
	Plastic adhesive card	0.78	102.720	0.011	1.150	
124	TOTAL	43.43	1321.29	0.05	51.56	Paperboard box, plastic window
	PB box	42.57	1028.940	0.049	50.830	
	Plastic window	0.86	292.350	0.003	0.731	
125	TOTAL	62.39	2256.12	0.04	73.51	3 Paperboard boxes, plastic outer wrap.
	3 PB box	58.11	1676.160	0.043	72.578	
	Outer plastic wrap	4.28	579.960	0.002	0.928	
126	TOTAL	74.87	1873.46	0.06	90.76	Paperboard box, plastic window in box.
	PB box	74.06	1627.220	0.055	89.823	
	Plastic window	0.81	246.240	0.004	0.936	
127	TOTAL	16.56	3548.80	0.01	14.95	6 Recloseable plastic pouches. Plastic outer wrap.
	6 Plastic pouches	13.32	2620.800	0.005	11.794	
	Outer plastic wrap	3.24	928.000	0.003	3.155	

C.35 Toilet Tissue Product Group

Product Number	Product Category	Brand Name	Label Size one square, cm2	Label Size one square, in2	Measured size one square, cm2	Measured size one square, in2	Uses per Container, 1 ft2 basis	Manufacturer Sheets per Container
128	Toilet Tissue	Charmin	130.64	20.25	132.16	20.48	79.67	560
		4 rolls			132.16	20.48	79.67	560
129	Toilet Tissue	Charmin	130.64	20.25	131.97	20.46	477.31	3360
		12 rolls			131.97	20.46	477.31	3360
130	Toilet Tissue	Scott	127.73	19.8	129.34	20.05	139.22	1000
		1 roll			129.34	20.05	139.22	1000

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
128	TOTAL	8.97	2800.49	0.00	8.12	4 toilet tissue rolls. Plastic outer wrap
	Outer plastic wrap	8.97	2800.490	0.003	8.121	
129	TOTAL	12.96	4649.74	0.00	14.41	12 toilet tissue rolls. Plastic outer wrap
	Outer plastic wrap	12.96	4649.740	0.003	14.414	
130	TOTAL	4.10	1312.78	0.03	32.82	Paper wrapped single toilet tissue roll
	Paper wrapping	4.10	1312.780	0.025	32.820	

C.36 Tomato Product Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Manufacturer Serving	Serving Size, g	Calories/ Serving
194	Tomato Product	Heinz	1814	64	1836	106	17	15
					1836	106	17	15
					1836	106	17	15
					1836	106	17	15
195	Tomato Product	Heinz	567	20	581	33	17	15
					581	33	17	15
					581	33	17	15
					581	33	17	15
196	Tomato Product	Spartan	196	40	1133	75	15	20
					1133	75	15	20
					1133	75	15	20
					1133	75	15	20
197	Tomato Product	Del Monte	794	28	812	47	17	15
					812	47	17	15
					812	47	17	15
					812	47	17	15

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
194	TOTAL	94.92	792.69	0.21	69.96	PET bottle, plastic/foil seal. PP cap.
	Plastic bottle	90.54	754.100	0.088	66.135	
	Foil Seal	0.13	1.770	0.020	0.035	
	Plastic cap	4.25	36.820	0.103	3.792	
195	TOTAL	43.06	360.64	0.21	32.03	PET bottle, plastic/foil seal. PP cap.
	Plastic bottle	38.66	321.990	0.088	28.239	
	Foil Seal	0.16	1.840	0.020	0.036	
	Plastic cap	4.24	36.810	0.102	3.755	
196	TOTAL	66.76	649.79	0.23	63.61	Plastic bottle, plastic/foil seal. PP cap.
	Plastic bottle	61.27	611.250	0.098	59.597	
	Foil Seal	0.25	1.740	0.020	0.034	
	Plastic cap	5.24	36.800	0.108	3.974	
197	TOTAL	51.80	612.31	0.22	58.79	Plastic bottle, plastic/foil seal. PP cap.
	Plastic bottle	44.33	573.680	0.096	54.959	
	Foil Seal	0.21	1.760	0.020	0.035	
	Plastic cap	7.26	36.870	0.103	3.798	

C.37 Toothpaste Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per Container, 1.572g basis	Manufacturer Serving	Use Amount, g	Calories/ Serving
226	Toothpaste	Crest	181	6.4	179.64	114.27	115	1.572	*
					179.64	114.27	115	1.572	
					179.64	114.27	115	1.572	
227	Toothpaste	Sensodyne	113	4	124	78.88	71	1.572	*
					124	78.88	71	1.572	
					124	78.88	71	1.572	
228	Toothpaste	Crest	24	0.85	29	18.45	15	1.572	*

					29	18.45	15	1.572	
					29	18.45	15	1.572	
229	Toothpaste	Colgate	170	6	184	117.05	108	1.572	*
					184	117.05	108	1.572	
					184	117.05	108	1.572	
230	Toothpaste	Crest	170	6	179	113.87	108	1.572	*
					179	113.87	108	1.572	
					179	113.87	108	1.572	
					179	113.87	108	1.572	
231	Toothpaste	Menta-Dent	99	3.5	107	68.07	62	1.572	*
					107	68.07	62	1.572	
					107	68.07	62	1.572	

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
226	TOTAL	25.19	707.91	0.07	27.03	Paperboard box, plastic/foil tube. Recloseable
	PB Carton	16.82	425.860	0.045	18.993	screw cap
	Plastic/foil tube	8.37	282.050	0.029	8.038	
227	TOTAL	16.02	558.51	0.07	19.34	Paperboard box,
	PB Carton	10.79	382.420	0.038	14.379	plastic/foil tube. Recloseable
	Plastic/foil tube	5.23	176.090	0.028	4.966	screw cap
228	TOTAL	10.36	324.54	0.07	10.95	Paperboard box,
	PB Carton	5.90	172.850	0.039	6.655	plastic/foil tube. Recloseable
	Plastic/foil tube	4.46	151.690	0.028	4.293	screw cap
229	TOTAL	18.31	368.60	0.07	23.64	Plastic self-standing laminate
	Plastic tube	18.29	368.220	0.064	23.640	tube. Flip top cap. Foil seal.
	foil seal	0.02	0.384	0.002	0.001	
230	TOTAL	30.53	617.59	0.12	31.41	Plastic self-standing plastic
	Plastic tube	28.44	273.880	0.109	29.743	tube. Foil/plastic bag inner.
	foil seal	1.19	244.240	0.004	1.001	Plastic seal
	Plastic seal	0.90	99.470	0.007	0.666	
231	TOTAL	136.52	1651.81	0.18	147.88	Paperboard box,
	PB Carton	34.79	814.680	0.054	44.156	Plastic 2-piece pump.
	Plastic pump	101.73	837.130	0.124	103.720	

C.38 Vegetable Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
219	Vegetables	W.M. Bolthouse Farms	1360	48	1374	6.17	222.86	17	78	35
					1374	6.17	222.86	17	78	35
220	Vegetables	W.M. Bolthouse Farms	454	16	468	2.10	222.86	5	78	35
					468	2.10	222.86	5	78	35
222	Vegetables	Spartan	453	16	467	1.92	242.86	5	85	35
					467	1.92	242.86	5	85	35
223	Vegetables	Del Monte	411	14.5	424	1.21	351.43	3.5	123	35
					424	1.21	351.43	3.5	123	35
					424	1.21	351.43	3.5	123	35
224	Vegetables	Freshlike	234	8.25	248	0.62	400.00	2	120	30

					248	0.62	400.00	2	120	30
					248	0.62	400.00	2	120	30
225	Vegetables	Freshlike	283.5	10	294	2.31	127.14	3	89	70
					294	2.31	127.14	3	89	70
					294	2.31	127.14	3	89	70

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
219	TOTAL	5.44	2027.37	0.003	5.68	LDPE bag
	Plastic bag	5.44	2027.370	0.003	5.677	
220	TOTAL	3.03	1180.06	0.00	3.30	LDPE bag
	Plastic bag	3.03	1180.060	0.003	3.304	
222	TOTAL	4.79	906.86	0.01	4.53	LDPE lap sealed bag
	Plastic bag	4.79	906.860	0.005	4.534	
223	TOTAL	54.67	733.65	0.05	23.49	2 piece steel can. Paper label.
	2 piece can	52.12	466.900	0.045	21.197	
	paper label	2.55	266.750	0.009	2.294	
224	TOTAL	31.47	359.81	0.04	8.94	3 piece steel can. Paper label
	3 piece can	30.09	208.970	0.038	7.857	
	paper label	1.38	150.840	0.007	1.086	
225	TOTAL	18.41	1101.40	0.04	22.89	Paperboard box,
	PB box	13.78	513.230	0.038	19.297	foil/paper/plastic wrap.
	Foil/paper/plastic outer	4.63	588.170	0.006	3.588	

C.39 Water Product Group

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, fl oz	Measured Weight, ml	Manufacturer Serving	Serving Size, ml	Calories/ Serving
100	Water	Evian	1500	50.7	1560	6	240	0
					1560	6		0
101	Water	Evian	1000	33.8	1070	4	240	0
					1070	4		0
102	Water	Evian	2000	67.6	2320	8	240	0
					2320	8		0
					2320	8		0
104	Water	Aquafina	2360	80	2442	10	240	0
					2442	10		0
					2442	10		0
105	Water	Absopure	4020	136	4178	17	240	0
					4178	17		0
106	Water	Crystal Geyser	3000	100	3180	12	240	0
					3180	12		0
					3180	12		0
107	Water	Absopure	4020	136	4255	8	240	0
					4255	8		0
108	Water	Country Fresh	3780	128	3945	15	240	0
					3945	15		0
109	Water	Country Fresh	9460	320	9950	39	240	0
					9950	39		0

Product Number	Material	Packaging Weight, g	Surface Area, cm2	Thickness, cm	Volume Material, cm3	Description
100	TOTAL	41.60	1414.64	0.0225	31.83	PET plastic bottle, plastic
	Plastic bottle/cap	41.60	1414.64	0.0225	31.83	screw closure
101	TOTAL	33.23	900.95	0.0265	23.88	PET plastic bottle, plastic
	Plastic bottle/cap	33.23	900.95	0.0265	23.88	screw closure
102	TOTAL	129.27	2478.46	0.0636	83.11	4 PET plastic bottles, 4 plastic
	4 Plastic bottle/cap	79.55	1003.26	0.0227	22.77	screw closures. Paperboard
	Paperboard	49.72	1475.2	0.0409	60.34	carton holder
104	TOTAL	120.62	3377.40	0.07	109.70	4 PET plastic bottles, 4 plastic
	4 Plastic bottle/cap	116.77	2877.88	0.0305	87.78	screw closures. Plastic ring
	Plastic ring holder	3.85	499.52	0.0439	21.93	holder
105	TOTAL	122.60	4240.01	0.07	283.66	PET gallon jug
	Plastic bottle/cap	122.60	4240.01	0.0669	283.66	
106	TOTAL	137.39	5820.93	0.03	106.01	6 PET bottles, 6 plastic closures
	6 Plastic bottle/cap	125.50	3689.11	0.0255	94.07	Bottles wrapped in outer plastic
	Outer plastic wrap	11.89	2131.82	0.0056	11.94	wrap
107	TOTAL	105.30	2587.22	0.03	80.72	PET bottle with handle
	Plastic bottle	105.30	2587.22	0.0312	80.72	
108	TOTAL	60.86	1583.80	0.04	67.63	HDPE gallon jug
	Plastic bottle	60.86	1583.8	0.0427	67.63	
109	TOTAL	212.27	2176.61	0.10	206.78	HDPE 2.5 gallon jug,
	Plastic bottle	212.27	2176.61	0.095	206.78	plastic spout

C.40 Yogurt Product Category

Product Number	Product Category	Brand Name	Label Weight, g	Label Weight, oz	Measured Weight, g	Uses per container, 100 cal basis	Serving Size, 100 cal basis	Manufacturer Serving	Serving Size, g	Calories/ Serving
211	Yogurt	Dannon	907	32	918	4.04	227.00	4	227	100
					918	4.04	227.00	4	227	100
					918	4.04	227.00	4	227	100
					918	4.04	227.00	4	227	100
212	Yogurt	Dannon	227	8	237	1.04	227.00	1	227	100
					237	1.04	227.00	1	227	100
					237	1.04	227.00	1	227	100
					237	1.04	227.00	1	227	100
213	Yogurt	Dannon	750	26.4	761	3.65	208.33	6	125	60
					761	3.65	208.33	6	125	60
					761	3.65	208.33	6	125	60
253	Yogurt	Dannon Duets	170	6	178	0.94	188.89	1	170	90
					178	0.94	188.89	1	170	90
					178	0.94	188.89	1	170	90
254	Yogurt	Yoplait	680	24	694	5.53	125.56	6	113	90
					694	5.53	125.56	6	113	90
					694	5.53	125.56	6	113	90
					694	5.53	125.56	6	113	90

Product Number	Material	Packaging Weight, g	Surface Area, cm ²	Thickness, cm	Volume Material, cm ³	Description
211	TOTAL	36.78	785.32	0.13	41.12	Polypropylene cup, plastic lid. Foil seal
	Plastic cup	27.43	525.080	0.060	31.347	
	Plastic lid	7.73	146.970	0.057	8.407	
	Foil seal	1.62	113.270	0.012	1.371	
212	TOTAL	13.22	360.67	0.09	14.33	Polypropylene cup, Polystyrene lid. Foil seal
	Plastic cup	10.65	203.850	0.060	12.272	
	Plastic lid	1.79	104.440	0.013	1.358	
	Foil seal	0.78	52.380	0.013	0.702	
213	TOTAL	32.34	1389.29	0.03	33.14	6 PP plastic cups, plastic/foil seals
	6 Plastic cup	30.66	1151.730	0.028	31.788	
	Plastic/foil seal	1.68	237.560	0.006	1.354	
253	TOTAL	14.46	449.99	0.05	14.27	Polystyrene tray, plastic/foil laminant seal
	PS plastic tray	13.69	349.230	0.039	13.690	
	Plastic/foil seal	0.77	100.760	0.006	0.584	
254	TOTAL	62.10	2151.03	0.08	63.75	6 PP plastic cups, 6 plastic/paper seals Paperboard outer carton
	6 Plastic cups	37.44	1280.530	0.027	34.318	
	6 Paper/plastic seals	1.84	242.900	0.006	1.506	
	PB carton	22.82	627.600	0.045	27.928	

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