NPB RESEARCH GRANT FINAL REPORT

Project Title: The potential for lean pork proteins to mitigate household food waste: an examination of ease of use and re-use in the kitchen
NPB Project Identification Number: #PR-005701
Principal Investigator: Brenna Ellison
Institution: Purdue University
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Industry Summary: Food waste is a global problem, and households are one of the most wasteful segments in the supply chain. Poor household food management is a common driver of food waste, and some foods, like proteins, are much more costly to waste (from an economic, environmental, and nutritional perspective) than others. In this project, we consider how easily lean and non-lean proteins can be used and re-used in the kitchen. We also assess how accurate consumers are in identifying lean and non-lean proteins. To accomplish this, we recruited a nationally-representative sample of approximately 1,000 US consumers to complete an online survey. We selected 16 protein sources -- 4 pork (pork loin, pork chop, bacon, pork ribs), 4 beef (ground beef, beef tenderloin, ribeye, chuck roast), 4 poultry (chicken breast, ground turkey, chicken thighs, chicken wings), and 4 other proteins (plant-based patty, tofu, salmon, shrimp) for consumers to evaluate. Protein sources were selected based on sales data of commonly purchased cuts, and each category has a mix of lean and non-lean protein sources. Our survey was designed to assess: 1) to what extent consumers can identify lean and non-lean proteins; 2) how easy or difficult it is to cook with each protein source; 3) how easy or difficult it is to re-purpose each protein source into a new meal; and 4) household cooking- and waste-related behaviors. Our survey results reveal three key findings. First, consumers' knowledge of lean proteins has room for improvement, particularly for cuts of pork. While we know many educational efforts are in place to promote lean pork proteins, our data suggests there is still a significant gap in knowledge as less than half of consumers correctly identified pork chops and pork loin as lean proteins. Second, we found that consumers are comfortable cooking a variety of proteins; however, lean pork proteins were not rated as easy to cook as some of their competitors. This suggests that additional education and outreach may be needed to highlight how convenient lean pork proteins can be utilized in households. There were also non-trivial shares of consumers who indicated they did not cook lean pork proteins at all, so there may be room to convert more consumers to lean pork proteins. Lastly, when considering how easy or difficult it is to re-use proteins, pork performed similarly to its competitors – with a large majority of consumers indicating they are easy to re-use. This is a positive signal in terms of promoting efficient household food management and food waste reduction.

Key Findings:

- Consumers can correctly identify some, but not all, lean proteins.
- Less than half of consumers believed pork loin (46.6%) and pork chops (32.9%) were lean proteins.
- Ground beef, chicken breasts, and bacon were considered easiest to cook for consumers; less than half of consumers considered pork chops (49.5%) and pork loin (42.9%) very easy to cook.
- Consumers believed that most proteins, including pork proteins, were easy to re-use if they had leftovers, which is positive from a food waste management perspective.

- Explaining results to academia colleagues: We would focus on the gaps in knowledge surrounding lean and non-lean proteins and discuss implications for diet quality as well as future Extension and outreach efforts. On the food waste side, we would focus on the potential costs of protein waste and look at households that may be more likely to waste proteins and discuss potential modes of intervention to reduce waste.
- Explaining results to pork producers: We would emphasize that more efforts are needed to educate the public that there are lean pork protein options and that there are easy ways to prepare them as that appears to be a barrier in the minds of consumers.
- Explaining results to industry partners: Again, we would emphasize the need for additional education and outreach as well as generating creative ideas/content to promote the ease of use of pork products.
- Explaining results to consumer media/public: Here, we would want to highlight what lean and non-lean proteins are and discuss the importance of lean proteins in your diet. On the food waste side, we would communicate out the costs of food waste, which are particularly high for protein, and the importance of having good strategies for use and re-use of protein foods in your kitchen to reduce waste.

Keywords: lean protein knowledge; ease of cooking; food re-purposing; food waste

Scientific Abstract: Food waste is a global problem, and households are one of the most wasteful segments in the supply chain. In this project, we investigate how food resource management and food waste vary concerning specific foods, specifically lean pork proteins and other lean proteins, with particular emphasis on their ease of use and re-use in the kitchen. We also explore consumers' ability to distinguish between lean and non-lean proteins. Using responses from a nationally-representative online survey, we find that 1) consumers can correctly identify some, but not all, lean proteins and 2) that some proteins are perceived as much easier to cook than others. Lean pork proteins, such as pork chops and pork loin, were incorrectly identified as non-lean by a large share of consumers and were not perceived to be as easy to cook as competing lean proteins. However, consumers generally believed that leftover proteins could be re-used easily, which is important for promoting food waste reduction and efficient food resource management.

Introduction: Food waste is a global problem. In the US and other developed countries, households have been identified as one of the most wasteful segments in the supply chain. The literature has identified several different drivers of food waste, including fear of illness, confusion around date labels, 'good host' mentality, and poor food resource management. In this project, we focus on the last driver identified – poor food resource management. Many households struggle with effective food resource management for a number of reasons (e.g., poor meal planning, limited time or ability to devote to cooking, household members do not want to eat leftovers), yet there is limited evidence on how households can differ and improve in this area. Consequently, our proposal centers on investigating how food resource management and food waste vary concerning specific foods, specifically lean pork proteins and other lean proteins, with particular emphasis on their ease of use and re-use in the kitchen.

Objectives: 1) Examine to what extent consumers believe lean pork proteins and other lean proteins are easy to use and re-use in the kitchen; 2) Assess which lean proteins are more or less likely to be wasted using experimental vignettes.

Subjects and Methods: To complete these objectives, we conducted an online survey with a nationally-representative sample of approximately 1,000 US consumers in May-June, 2024. Our survey and research protocol were approved by Purdue's Institutional Review Board. Participant recruitment and payment was managed by prolific.

In our survey, we selected 16 protein sources -- 4 pork (pork loin, pork chop, bacon, pork ribs), 4 beef (ground beef, beef tenderloin, ribeye, chuck roast), 4 poultry (chicken breast, ground turkey, chicken thighs, chicken wings), and 4 other proteins (plant-based patty, tofu, salmon, shrimp) for consumers to evaluate. Protein sources were selected based on sales data of commonly purchased cuts, and each category has a mix of lean and non-lean protein sources. Our survey was designed to assess: 1) to what extent consumers can identify lean and non-lean proteins; 2) how easy or difficult it is to cook with each protein source; 3) how easy or difficult it is to re-purpose each protein source into a new meal; and 4) household cooking- and waste-related behaviors. We also included experimental vignettes that ask participants to consider what they would do with leftover proteins in certain situations; in these vignettes, we vary protein source; cost of protein; and whether the leftover protein can be re-heated as is for a meal or whether it requires additional ingredients to re-purpose for a new meal. These vignettes can provide insights as to what drives the keep/waste decisions as it relates to proteins.

Results: In the following section, we present our results by objective. While our project did not have a stated objective on assessing knowledge of lean proteins, we thought it was important to determine if consumers could accurately identify lean and non-lean proteins before we asked about their use and re-use behaviors with them. To that end, we first asked consumers whether each of the 16 proteins selected was a lean protein or a non-lean protein; consumers could also select I don't know as a response. As can be seen in figure 1, a large majority of consumers correctly identified chicken breasts (90.7%) and ground turkey (82.4%) as lean proteins. The plant-based and seafood proteins were also believed to be lean proteins by most participants, though there was more uncertainty around plant-based patties and tofu based on the larger shares of 'I don't know' responses. In the case of pork, consumers were less accurate at identifying lean proteins. Only 46.6% of consumers correctly identified pork loin as a lean protein, and only 32.9% correctly identified pork chops as lean.

Results for Objective 1: For the 16 protein sources, we first asked consumers how easy or difficult they thought it was to cook with each. Response options were: very easy to cook; neither easy nor difficult to cook; very difficult to cook; or I don't cook this protein. Figure 2 presents the results for this question. As can be seen in the figure, over 70% of consumers rated ground beef, chicken breasts, and bacon as very easy to cook. Chicken thighs, ground turkey, shrimp, salmon, and chicken wings were also rated as very easy to cook by at least half of participants. Outside of bacon, pork products were not perceived as easy to cook; pork chops and pork loin were rated as easy to cook by 49.5% and 42.9% of consumers, respectively. Pork ribs were considered to be one of the most difficult proteins to cook, with 12.1% of consumers rating them as very difficult to cook. Figure 2 also reveals there are many proteins that consumers simply choose not to cook. Tofu and plant-based patty have the highest shares of do not

cook (46.4% and 45.2%, respectively); however, roughly 20-30% of consumers also indicated they do not cook pork chops, pork loin, or pork ribs. While one might ask whether this is an overall aversion to pork, only 10% of consumers indicated they do not cook bacon, so this does not appear to be the case.

In terms of protein re-use, we asked consumers how easy or difficult it would be to use proteins if they had them as leftovers (individuals were only asked about proteins that they cooked). Response options were very easy to re-use; neither easy nor difficult to re-use; very difficult to re-use. Figure 3 presents the percent of consumers that said it would be very easy to re-use each protein. Generally, a majority of consumers (50% or more) indicated that it would be very easy to re-use each type of protein, with the lone exception being tofu. Chicken breasts, ground beef, and chicken thighs were rated very easy to re-use by the largest share of consumers.

Results for Objective 2: Our analysis of these results is ongoing; however, we find that, in general, consumers are averse to wasting proteins. Waste is more likely to happen when the cost of protein is lower, which is consistent with previous research, and when more effort is needed to transform the protein into a new meal (there is not enough left to eat on its own). We observe some differences by protein type, but are still analyzing these results in further detail.

Discussion: Overall, our results point us to a few key findings. First, consumers' knowledge of lean proteins has room for improvement, particularly for cuts of pork. While we know many educational efforts are in place to promote lean pork proteins, our data suggests there is still a significant gap in knowledge as less than half of consumers correctly identified pork chops and pork loin as lean proteins. Secondly, we found that consumers are comfortable cooking a variety of proteins; however, lean pork proteins were not rated as easy to cook as some of their competitors. This suggests that additional education and outreach may be needed to highlight how convenient lean pork proteins can be utilized in households. There were also non-trivial shares of consumers who indicated they did not cook lean pork proteins at all, so there may be room to convert more consumers to lean pork proteins. When considering how easy or difficult it is to re-use proteins, pork performed similarly to its competitors – with a large majority of consumers indicating they are easy to re-use. This is a positive signal in terms of promoting efficient household food management and food waste reduction.

Scientific Presentations: We intend to submit an abstract related to the ease of use/re-use of proteins and the experimental vignettes to the Agricultural and Applied Economics Association annual meeting, which will be held in Denver in July 2025.

Publication(s): We intend to split our work into two manuscripts. The first manuscript will focus on consumers' knowledge of lean and non-lean proteins, as our results suggest there is likely some work to do on the consumer education front. We plan to draft a research brief that can be submitted to the *Journal of Nutrition Education and Behavior*. For the second manuscript, we will focus more on the potential for protein food waste, including the ease of use and re-use data as well as the experimental vignettes. We have not decided on a final journal, but are considering options such as *Appetite*; *Resources, Conservation, and Recycling*; or *PLoS ONE*.

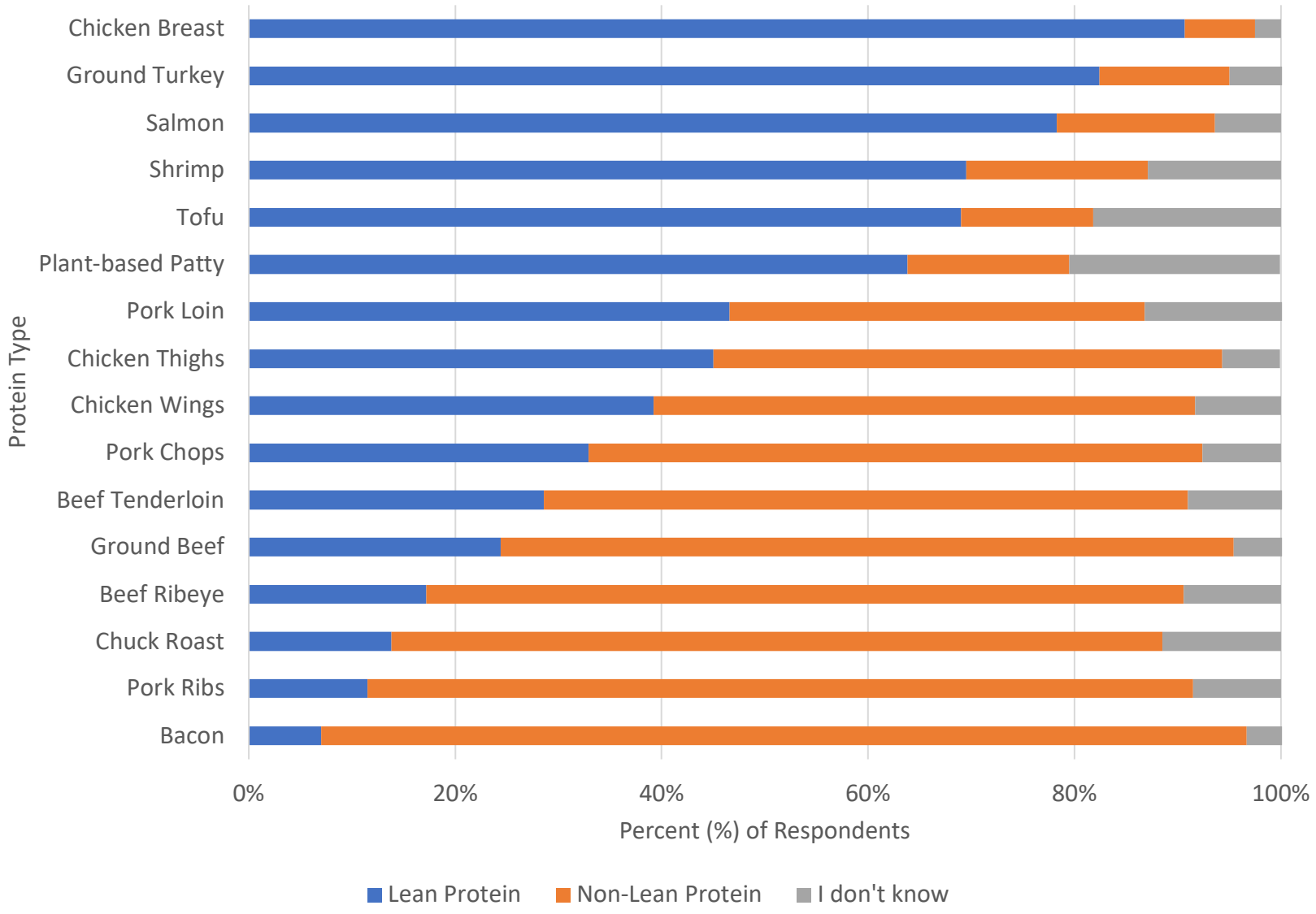


Figure 1. Consumer Perceptions of Lean and Non-Lean Proteins

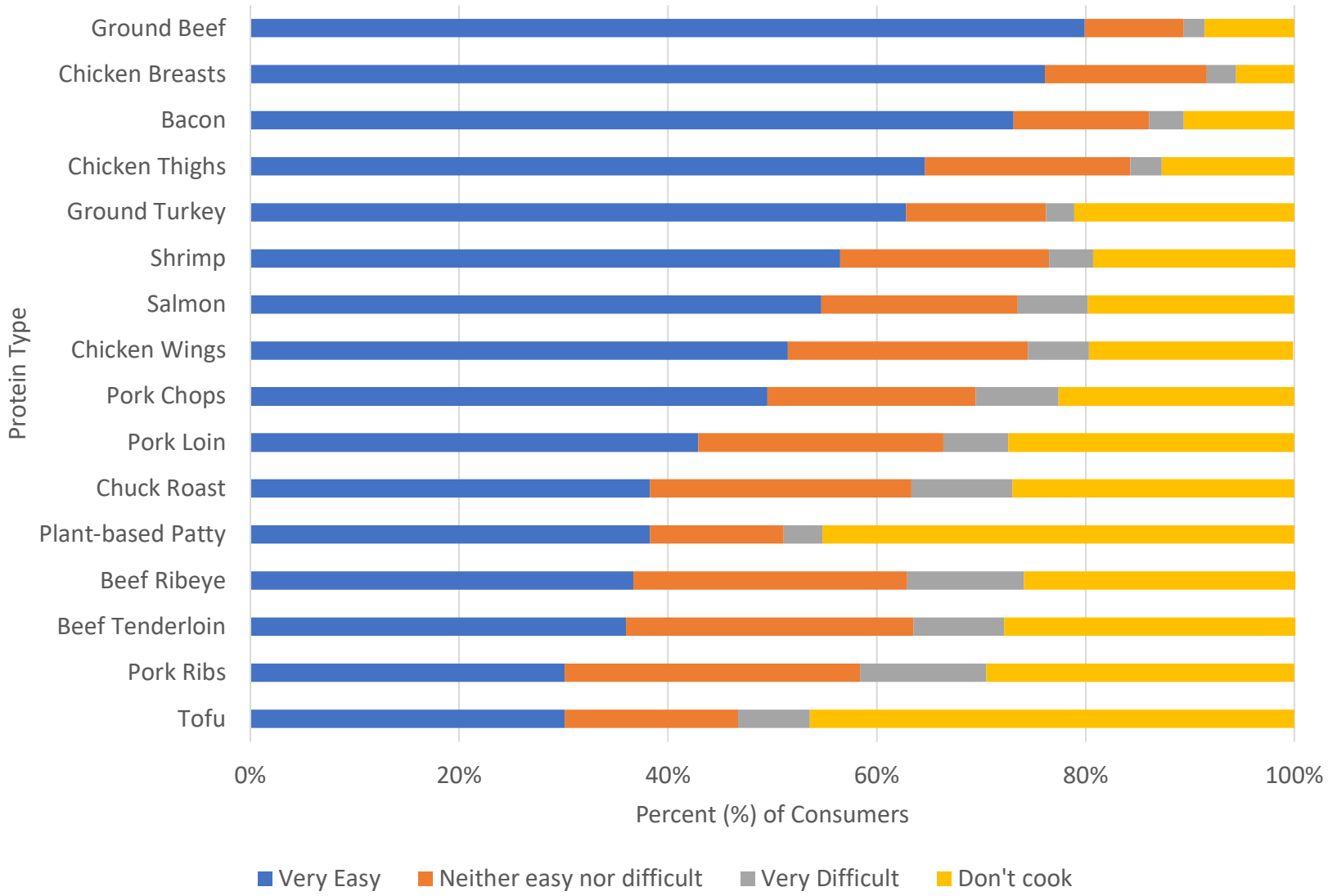


Figure 2. Perceived Ease of Cooking by Protein Type

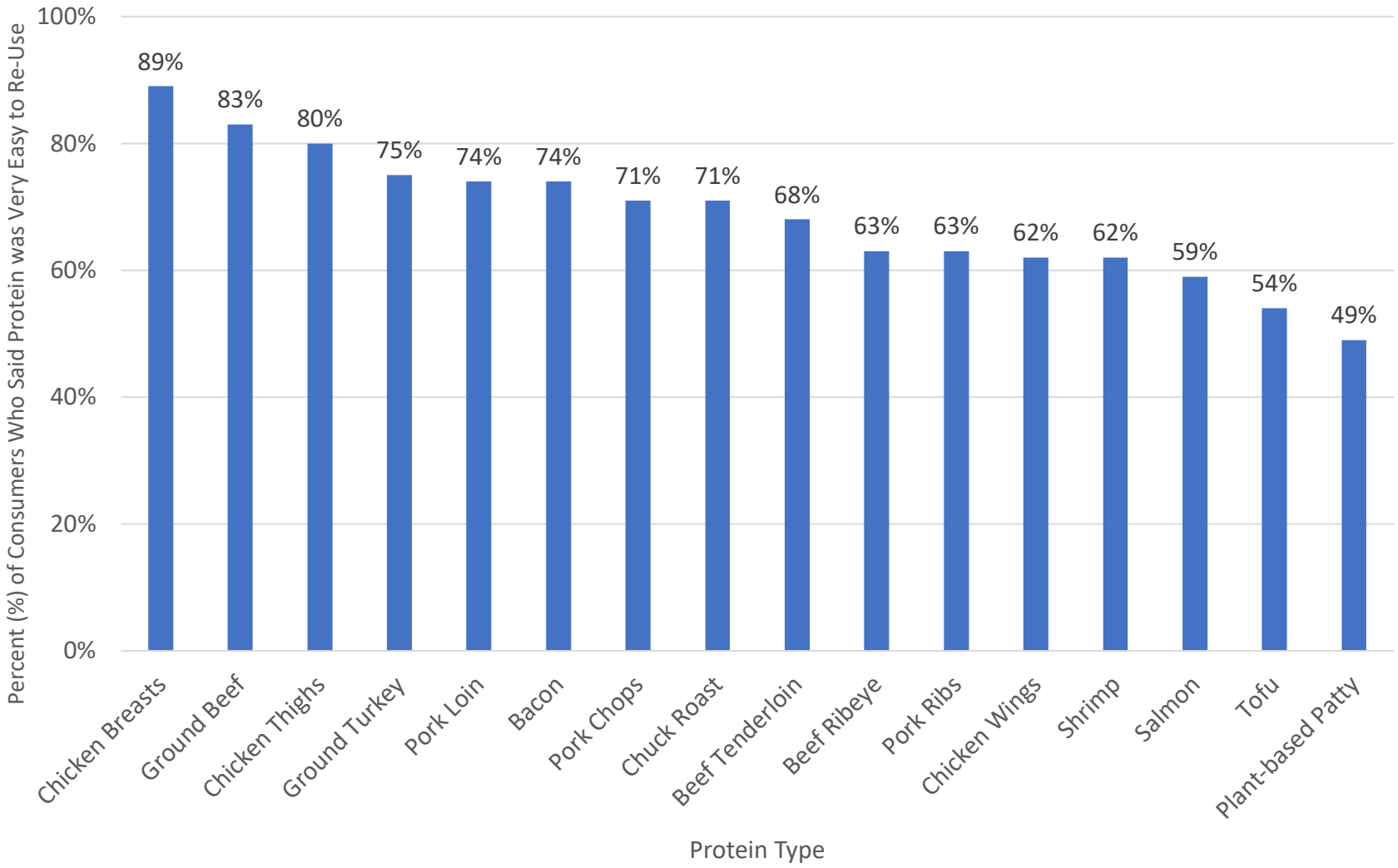


Figure 3. Percent of Consumers Who Believe Proteins are Easy to Re-Use, by Protein Type (Note: For each protein type, only consumers who indicated they cooked the protein were asked to complete this question.)