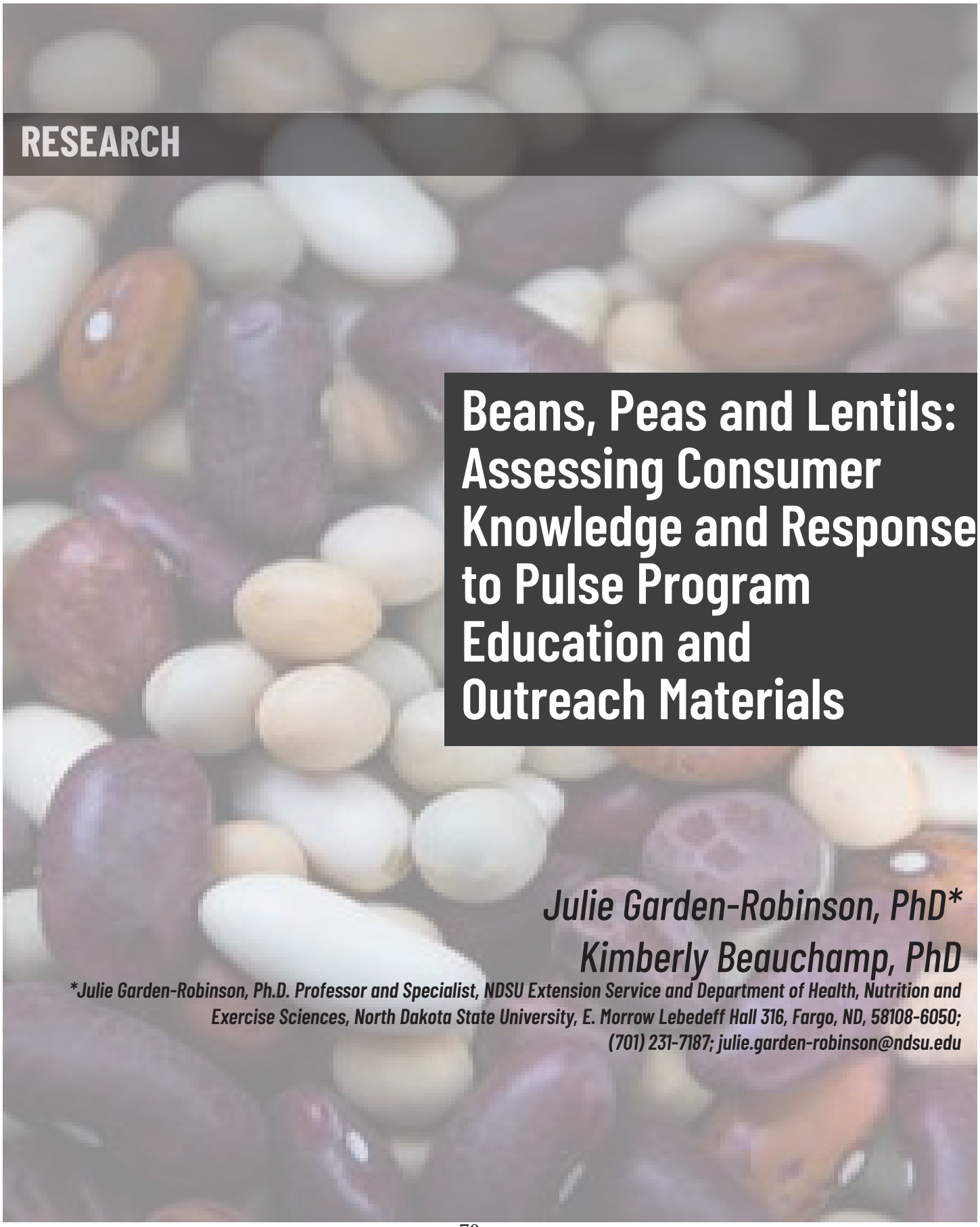

RESEARCH

Beans, Peas and Lentils: Assessing Consumer Knowledge and Response to Pulse Program Education and Outreach Materials

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Abstract

Pulses, which include dry beans, lentils, and peas, are increasingly recognized by nutrition researchers for their role in promoting health. The purpose of this online study was to explore how variations in recipe presentation and preexisting pulse-product knowledge interact to affect behavioral intentions to modify pulse-product consumption. This study incorporated a between-subjects experimental design where an accessible sample (n=385) was drawn from the U.S. target population. Participants were predominantly female, white, non-Hispanic, and non-students. Our results suggested a specific condition that an education and outreach effort will more likely (rather than unlikely) predict a significant positive effect on people's intentions to increase weekly consumption of pulse products. The project has potential implications for professionals who teach nutrition and food preparation. Many nutrition education professionals use recipes to introduce less-familiar foods and to engage their participants in their content. This study supports providing adequate background information about recipe components, nutritional value, and their health implications before exposing people to recipe variations. Further, our findings indicate that audience assessment and segmentation may empower professionals to tailor education and outreach programs to address variations in the preexisting knowledge of a target audience.

Introduction

Pulses, provide an economical source of protein, dietary fiber including heart-healthy soluble fiber, and several vitamins, including the B vitamin folate, and minerals including iron, magnesium, potassium, phosphorus, and zinc (Hall, Hillen, & Garden-Robinson, 2016; Rebello, Greenway, & Finley, 2014). Adults need 21 to 38 grams of fiber per day. About 90% of women and 97% of men do not meet the recommendations for fiber intake (USDA, 2020), making beans and other pulses a solution to help fill the fiber gap in many diets. For example, cooked split peas provide 16 grams (g) of fiber per cup, lentils provide 15.6 g per cup, and black beans provide 15 g per cup. Incorporating these foods could fill the gap in fiber in many diets while providing protein and other valuable nutrients in the diets of adults and children.

Literature Review

Studies suggest that regular consumption of pulses may reduce the risk of heart disease, diabetes, and certain types of cancer (O'Neil, Nicklas, & Fulgoni, 2014, Singhal, Kaushik, & Mathur, 2014). Botanically, pulses are members of the *Leguminosae* family, which include dry beans (e.g., navy, kidney, pinto, black beans), dry peas (e.g., chickpeas or garbanzo beans, black-eyed peas, and split peas), lentils, lupins, and several other types. The role of pulses in promoting good health is associated with its nutritional composition. The Food and Agriculture Organization (FAO) promoted the "International Year of Pulses" 2016 to raise awareness of the role that pulse foods play in human nutrition throughout the world. Each year, the FAO continues to promote "World Pulses Day" on February 10 (FAO, 2023).

As with previous editions, the Dietary Guidelines for Americans (DGA) (U.S. Department of Agriculture [USDA], 2020) promotes frequent consumption of beans, lentils, and dry peas. MyPlate, as the graphic icon for the DGA, recognizes beans, lentils, and dry peas as unique foods. When tracking food choices, pulses can count either as a vegetable or a protein. For example, people tracking their food servings for a vegetarian diet would typically count pulse foods as a protein. In contrast, people who consume meat would count pulse foods as a vegetable, until recommendations are met. One-fourth cup of cooked beans would be a 1-ounce equivalent in the protein group. One cup of whole or mashed, cooked beans, lentils, or peas would count as one cup of vegetables. Adults need 5-to-7-ounce equivalents of protein and 2-to-4 cups of vegetables, depending on age and sex (USDA, n.d.).

Purpose

The purpose of this study was to explore how variations in recipe presentation and preexisting pulse-product knowledge interact to affect behavioral intentions to modify pulse-product consumption. We proposed an overall hypothesis that: Recipe variation will interact with preexisting pulse-product

knowledge to affect behavioral intentions to modify pulse product consumption (H1). An objective of this study was to identify If, when, and how a recipe variation would differentially impact behavioral intentions. To explore the conditional direct effect of the recipe variation on intentions, we the hypothesized that: A video-enhanced recipe variation (compared to a print-only recipe variation) will have a more positive impact on behavioral intentions, regardless of preexisting pulse-product knowledge (H1a).

Methods

This Pulse Program was partly supported by a USDA Specialty Crop grant awarded in 2020. The North Dakota State University (NDSU) Institutional Review Board (IRB) approved the online study before any data were collected. All data were collected between November 7, 2022 and January 8, 2023. This study incorporated a between-subjects experimental design where an accessible sample was drawn from the U.S. target population. Participants were recruited through a news column that ran online and in newspapers in the Midwest, social media platforms (Facebook, Twitter), and listservs to county Extension Offices and their county agents. Individuals were provided a link to the online study via the news column (online and print), social media, and email listservs. Recruiting incentives were offered to encourage study participation. Each prize packet included at least two items selected from a 2023 nutrition education calendar, a refrigerator magnet, full-color handouts about pulses, a cookbook, and/or a meat thermometer.

The Qualtrics software system licensed to NDSU randomly assigned participants to one of two experimental conditions. For the control condition, participants were randomly assigned to receive one of three print recipes: Cowboy Caviar (beans); Greek Lentil Salad (lentils); Split Pea Salsa (peas). All print recipes were similar in design to include a photo of the finished entrée, a list of ingredients, preparation instructions, cooking instructions, and a description of the entrée's nutritional value. Each print recipe was converted into a YouTube video demonstration of the recipe. For the treatment condition, participants were randomly assigned to receive one of three video-enhanced print recipes: Cowboy Caviar (beans); Greek Lentil Salad (lentils); and Split Pea Salsa (peas). All video recipe demonstrations were similar in design to include background music, closeup demonstrations (i.e., hand shots) of ingredient preparation, demonstrations of cooking procedures, text overlays to describe each step of the recipe preparation process, an image of the finished entrée, and a screenshot of the printed recipe. Thus, while the control and treatment conditions included the print recipe, the treatment condition was additionally enhanced to include the elements of a video demonstration.

Upon accessing the website, the participants were asked to read an online consent form. By checking two boxes, individuals indicated that they had read the form and consented to participate in the study. The first question asked consenting participants to indicate their age as either 'less than 18 years old,' or 'at least 18 years old.' Individuals more than 18 years of age continued with the first survey. Individuals less than 18 years of age were thanked for their response and redirected to the NDSU Extension website (https://www.ndsu.edu/agriculture/extension/extension-topics/food-and-nutrition/subscribe-food-nutrition-newsletters).

Upon completing the first survey, participants clicked on a link and were redirected to a second survey located on a separate website. Through the second survey, participants were able to provide contact information so that the study coordinator could provide the incentive items to participants via the U.S. Postal Service. Responses to the first survey were not linked to the second survey.

Groups and Measures

General Demographics

The first survey included three items to collect participants' general demographic information (i.e., sex, ethnicity, student status; see Table 1). Participants self-identified as being 'female' (coded as 0.5) or 'male' (coded as -0.5). Participants indicated their ethnicity as 'Hispanic' (coded as 0.5) or 'non-Hispanic' (coded as -0.5). Participants also indicated whether they were 'currently a student' (coded as 0.5) or 'not currently a student' (coded as -0.5).

Individual Difference Variable: Preexisting Knowledge

To measure preexisting knowledge of pulse products, all participants were asked 'What are pulses?' before being exposed to a recipe variation. Participants answered this question by selecting a response from four multiple-choice options: a) pulses are dry beans, dry peas, lentils, soybeans, and peanuts; b) pulses are dry beans, peas, and lentils; c) pulses are dry beans only; d) I do not know. Participants selecting option 'b' were placed in the 'correct answer group' (coded as 0.5). Participants selecting option 'a,' 'c,' or 'd' were placed in the 'incorrect answer group' (coded as -0.5).

Predictor Variable: Recipe Variation

As noted earlier, six recipe variations were developed and served as stimuli for our study: video-enhanced print recipe (i.e., Cowboy Caviar; Greek Lentil Salad; Split Pea Salsa); print recipe without video enhancement (i.e., Cowboy Caviar; Greek Lentil Salad; Split Pea Salsa). The group viewing a video-enhanced print recipe was coded as: 0.5 (treatment condition). The group viewing a print recipe without video enhancement was coded as: 0.5 (treatment condition) and -0.5 (control condition).

Dependent Variable: Behavioral Intentions

Three items were developed for this study to assess participants' self-reported intentions to modify weekly consumption of beans, lentils, and split peas. First, participants in the treatment and control conditions read a base statement (e.g., 'As a healthful choice, the total amount of beans (other than green beans) that I consume on a weekly basis should be' ...) and completed this statement using a 7-point scale ranging from 1 ('decreased a lot') to 7 ('increased a lot'). Second, participants read a base statement (e.g., 'As a healthful choice, the total amount of lentils that I consume on a weekly basis should be' ...) and completed this statement using a 7-point scale ranging from 1 ('decreased a lot') to 7 ('increased a lot'). Finally, participants read a base statement (e.g., 'As a healthful choice, the total amount of split peas that I consume on a weekly basis should be' ...) and completed this statement using a 7-point scale ranging from 1 ('decreased a lot') to 7 ('increased a lot').

The three behavioral intention items were subjected to a principal components analysis (PCA) to determine if they formed a reliable measure, as a scale. The Kaiser-Meyer-Olkin (KMO) value (0.71) exceeded Kaiser's (1970, 1974) recommended value of 0.60. From the correlation matrix, all three items had correlations of 0.3 or higher. The PCA revealed the presence of one component, with an eigenvalue of 2.31 that explained 77.1% of the total variance. A scree-plot inspection confirmed a clear break after the second component. The factor loadings of the single component ranged from 0.84 to 0.91. Given the PCA results, testing the reliability of the composite scale was justified. Indeed, an index including the three items revealed a reliable three-item scale for behavioral intentions (α = 0.85, Mean = 16.17, SD = 3.01, Variance = 9.08), with higher scores reflecting a more optimal response.

Results

Of the total sample (n = 385), 81,3% were female, 91.4% self-identified as white, 89.4% identified as non-Hispanic, 100% were at least 18 years of age, and 92.9% were non-students (see Table 1). Approximately 45.5% of the participants were exposed to a video-enhanced print recipe. About 54.5% of the participants were exposed to the print recipe without the video enhancement. Among individuals viewing a video recipe (treatment condition), roughly 37.7% correctly identified pulse products before recipe exposure. Among those reading a print recipe (aka control condition), approximately 32.8% correctly identified pulse products before recipe exposure. (Table 1)

We conducted a 2 (condition) x 2 (preexisting knowledge) univariate analysis to test our overall hypothesis (H1). The composition of the condition and preexisting knowledge groups can be found in Table 2. The data revealed a significant interacting effect between condition and preexisting knowledge on behavioral intentions to increase pulse product consumption [F (1,385) = 5.26, $p < 0.05$]. Thus, our data provided support for our overall hypothesis (H1) that stated: Recipe variation will interact with preexisting pulse-product knowledge to affect behavioral intentions to modify pulse product consumption (H1). (Table 2)

As shown in Figure 1, when preexisting pulse-product knowledge was accurate, behavioral intentions did not differ to a statistically significant degree between individuals reviewing a video-enhanced print recipe and individuals reviewing a print recipe without the video enhancement (*Mean* = -0.26, *SE* = 0.172, $p > .05$). When preexisting knowledge was inaccurate, behavioral intentions did not differ to a statically significant degree between individuals reviewing a video-enhanced print recipe and individuals reviewing a print recipe without the video enhancement (*Mean* = -0.24, *SE* = 0.127, $p > .05$). When participants viewed a video-enhanced recipe, behavioral intentions did not differ to a statistically significantly degree between individuals with accurate preexisting knowledge and individuals with inaccurate preexisting knowledge (*Mean* = -0.07, *SE* = 0.155, $p > .05$). However, when individuals viewed the print-only recipe, behavioral intentions were significantly lower among those with accurate preexisting knowledge compared to those with inaccurate preexisting knowledge (*Mean* = -0.42, *SE* = 0.146, $p < .05$). Thus, we found no support for our working hypothesis (H1a) that stated: A video-enhanced recipe variation (compared to a print-only recipe variation) will have a more positive impact on behavioral intentions, regardless of preexisting pulse-product knowledge (H1a). (Figure 1)

Discussion

The Pulse Program illuminated the importance of assessing consumer knowledge plus people's response to the education and outreach materials. When testing consumers' reactions and response to recipe variations, the data suggest the need to take consumers' individual differences into consideration. For this study, we included preexisting pulse-product knowledge as an individual difference variable in the statistical analysis.

This online experiment demonstrated that survey participants' preexisting knowledge of pulse products interacted with recipe variation to motivate increased consumption of pulse products. Although the data revealed a significant interaction between recipe variation and preexisting pulse-product knowledge on behavioral intentions (H1), we found one significant conditional direct effect of recipe variation. For people exposed to a print-only recipe variation, individuals with accurate preexisting knowledge (rather than inaccurate) reported significantly higher intentions to increase pulse-product consumption. However, we found no statistically significant difference in the conditional direct effect of a video-enhanced recipe variation on behavioral intentions, compared to the effect of a print recipe without video enhancement. Taken together, these results suggested a specific condition that an education and outreach effort will likely (rather than unlikely) predict a significant positive effect on people's intentions to increase weekly consumption of pulse products. The fact that individuals with accurate (rather than inaccurate) preexisting pulse-product knowledge were significantly more likely to increase pulse-product consumption after viewing a print-only recipe variation, suggests that education and outreach programs should take consumers' preexisting knowledge into consideration.

Study Limitations

We engaged only participants in this project who had internet access on a computer, phone, tablet, or other device. Most of our participants were non-Hispanic, white, females, and not currently enrolled as a student. Further, we found that attracting participants in online research studies can be challenging, even when incentive items are offered.

Implications For Professionals and Future Directions

The project has potential implications for professionals who teach nutrition and food preparation. Many nutrition education professionals use recipes to introduce less-familiar foods and to engage their participants in their content. This study supports providing adequate background information about recipe components, nutritional value, and their health implications before exposing people to recipe variations. Further, our findings indicate that audience assessment and segmentation may empower professionals to tailor education and outreach programs to address variations in the preexisting knowledge of a target audience.

Nutrition concepts are complex, and the DGA change as more research is conducted and published. Many people are not familiar with the specifics of nutrition; therefore, crafting user-friendly materials is important. Educational materials can effectively motivate consumers toward optimal behavioral intentions to increase pulse-product consumption, when preexisting knowledge of pulse products is taken into consideration. A combination of communication, outreach, and education studies need to identify effective strategies for increasing pulse-product consumption. While this study targeted a general U.S. population, additional studies are needed to also explore how population diversity (e.g., attentive to individual differences) may interact with recipe variations and preexisting knowledge to influence people's intentions to increase weekly consumption of pulse products. Educational pulse resources used in this project are available at https://www.ndsu.edu/agriculture/extension/extension-topics/food-and-nutrition/food-preparation/cooking-basics/beans-lentils.

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Table 1

Demographic Information of Survey Participants

Demographic data	Percentages	Number
Sex		
Female	81.3%	313
Male	18.7%	72
Ethnicity		
Hispanic	10.6%	41
Non-Hispanic	89.4%	344
Student Status		
Student	7.1%	27
Non-student	92.9%	358

Note: All participants were at least 18 years of age.

Table 2

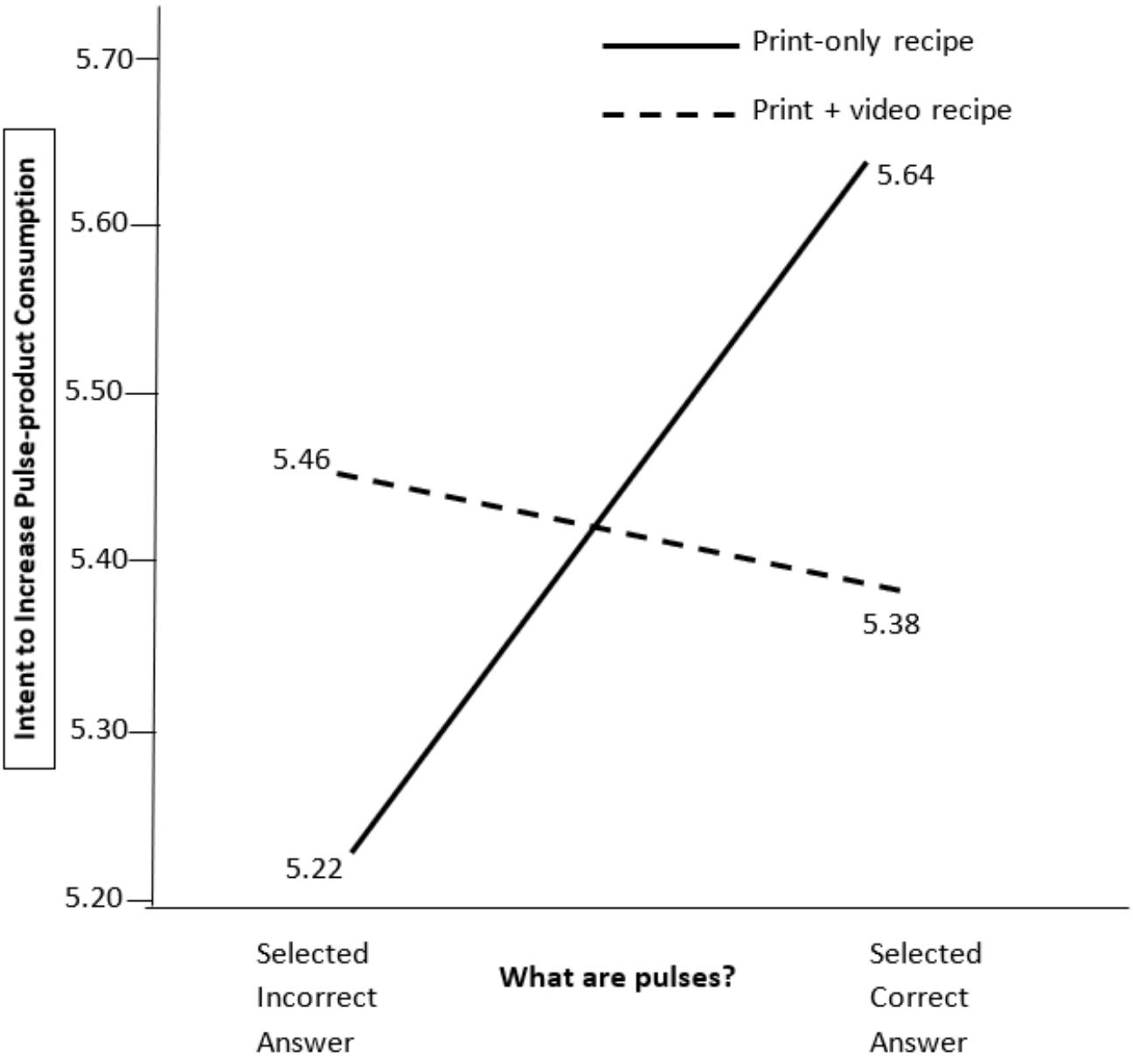
Knowledge of Pulse Products Prior to Recipe Exposure in Video/ and/or Print Format

Groups	Exposed to a video-enhanced print recipe	Exposed to a print recipe without video enhancement	Totals
Correctly identified pulse products	37.7% (n=66)	32.8% (n=69)	35% (n=135)
Incorrectly Identified pulse products	62.3% (n=109)	67.2% (n=141)	65% (n=250)
Totals	100% (n=175)	100% (n=210)	100% (n=385)

Note: Prior to recipe exposure, participants indicated their knowledge of pulse products. Using a scale of 1 to 7, participants indicated the extent that they should modify their weekly intake of pulse products. Higher scores reflected an intent to increase consumption of pulse products.

Figure 1

Estimated Marginal Means of Change in Consumption of Pulse Products



Note: Prior to recipe exposure, participants indicated their knowledge of pulse products. Using a scale of 1 to 7, participants indicated the extent that they should modify their weekly intake of pulse products. Higher scores reflect an intent to increase consumption of pulse products.