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Using a fractional model to measure the impact of antioxidant information, price, and liking on purchase intent for specialty potatoes

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ABSTRACT

A procedure for analyzing categorical purchase intent data from consumer tests is demonstrated using data from a test of fresh market specialty potato varieties. Due to the probabilistic nature of purchase intent a fractional model is based, just as a binary choice analysis using probit or logit would be, on a non-linear cumulative distribution function. The results from a fractional model are compared to an ordinal model.

Participants in the consumer test evaluated six unreleased varieties and one commonly available variety of potato, the Yukon Gold. Four of the new varieties had colored red or purple flesh rated highly for antioxidant content. The effect of antioxidant information and other variables on the probability of purchase for red and purple potatoes was compared to the effect on the yellow potatoes using a fractional model and an ordinal model. Other variables include liking, price, gender, age, education, income, potato usage frequency, health interest, and food interest. As expected hedonic ratings and price had significant positive and negative effects respectively on purchase intent for both categories of potatoes. Antioxidant information, whether simple or detailed, increased purchase intent for the colorful potato varieties. Interactive variables between health interest and antioxidant information level demonstrate the impact of personal health interest in conjunction with the information.

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1. Introduction

Moskowitz, Muñoz, and Gacula (2008) report that purchase intent questions are typically not used by sensory analysts because it requires that the participant make a decision that goes beyond the sensory properties, nevertheless, purchase intent is of critical interest to marketers and quite often included in consumers tests. Other factors; such as price, convenience, advertising and promotions have all been demonstrated as important in actual purchasing. They note that a purchase intent question will provide little information not provided in a liking question unless accompanied by the knowledge they may receive at point of purchase.

The marketing literature has extensively examined the ability of surveyed purchase intent responses to predict actual purchases using follow-up surveys. They have provided simple linear relationships that provide a downward modification of surveyed

purchase intent which can be further adjusted with additional information about the product for example-durables versus non-durables. More complex models are based on the initial purchase intent and then modified with information about the marketing efforts planned. One of the most successful (Clancy, Krieg, & Wolf, 2006, p. 45) of the simulated test marketing systems, BASES, begins with the 5-point categorical purchase intent scale.

In this paper we describe an approach to utilize categorical purchase intent questions accompanied by point of purchase type information in a consumer test to capture information about the impact of credence attributes such as nutritional information and consumer characteristics as well as sensory attributes. Two possible analytical methods, a fractional approach treating the categories as purchase intent probabilities and an ordinal approach treating them as an ordered choice, are described and compared in terms of ability to predict purchase intent and in what each tells us about how much each explanatory factor changes purchase intent. In comparison to alternatives these approaches fit well within a consumer test and provide a rigorous analytical procedure. Both approaches work well, but one provides for more direct interpretation and lends itself more readily to graphical representation.

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There are other useful approaches to examining choices with respect to complex purchase intent decisions. If the need is to examine several credence product attributes simultaneously such as brand, price, label details, and ingredient levels a choice experiment such as that utilized in [Ennekking, Neumann, and Henneberg \(2007\)](#) is useful. Though choice experiments analyzed with the multinomial model are valuable for examination of multiple credence attributes, they are not fully compatible with a standard consumer test whose first priority is sensory evaluation. The approach developed here fits well into a multiple product test though, as with a choice experiment, fewer credence attributes can be examined unless more consumers are tested.

1.1. Background

In the last decade research programs have been developing colored flesh potatoes at least partly in the interest of making their greater nutritional properties available. To encourage the adoption of these varieties by producers, and the use of them by consumers, it is important to examine consumer's willingness to purchase these varieties and to examine whether providing information about the nutritional properties will assist in marketing those potatoes. It is also critical that a premium price can be obtained to produce and distribute these potatoes when costs to produce and distribute them are higher than for conventional varieties. This study examines these factors using data collected during a consumer test including both highly colored and more conventional yellow fleshed and skinned specialty potato varieties.

Surveys conducted by the [United States Potato Board \(2002\)](#) indicated that 57.2% of consumers ranked quality, appearance, or color to be more important in their potato buying decision than price, with only 18.2% of consumers considering price the most important factor. Despite price not ranking as the most important by many it is still a critical or determining factor for nearly all consumers and helps to measure the importance of all other factors.

Assuming that varieties introduced to the market meet basic consumer standards, the focus shifts to other factors that may influence purchase, and these factors can be intrinsic or extrinsic in nature ([Di Monaco, Cavella, Torrieri, & Masi, 2007](#)). For potatoes, intrinsic factors are those which are associated with their sensory properties (i.e. appearance, flavor, texture). Extrinsic factors lie outside of these basic characteristics, and can be in the form of information about cultivar name or origin, suggested preparations or recipes, price, packaging, nutritional properties, or potential health benefits. Out of these extrinsic factors, the impact of health benefits on purchase intent for fresh market potatoes has not been explored.

Exploring the impact of health benefits on purchase intent is particularly relevant for colorful potato varieties, as they exhibit unique health properties associated with their pigment. Colorful potatoes have high levels of antioxidants, including anthocyanins, carotenoids, phenolics, and vitamin C ([Brown, 2005](#); [Woolfe, 1987](#)). Red and purple (skin and flesh) potatoes contain the highest levels of these compounds ([Lachman, Hamouz, & Orsak, 2005](#)). Purple fleshed potatoes have ten times the anthocyanin content of red fleshed potatoes ([Lewis, Walker, Lancaster, & Sutton, 1998](#)). Purple skinned potatoes also have high levels of phenolic acids and purple fleshed potatoes have been reported to have twice the level of flavonoids as white fleshed potatoes ([Lewis et al., 1998](#)). Yellow (skin and flesh) potatoes have higher levels of carotenoids than white fleshed potatoes ([Brown, Culley, Bonierbale, & Amoros, 2007](#); [Brown, Culley, Yang, Durst, & Wrolstad, 2005](#); [Tevini & Schonecker, 1986](#)), and the deeper the color, the greater the antioxidant value ([Iwanzik, Tevini, Stute, & Hilbert, 1983](#)). [Brown et al. \(2005\)](#) studied red and purple potatoes with anthocyanin levels from 17 to 38 µg per 100 g. of potato, which they

compare to strawberry varieties ranging from 15 to 25 reported by [Clifford \(2000\)](#) and ORAC level in percent compared to white flesh potatoes of 183–330 for red fleshed potatoes which they compare to red bell pepper, broccoli, and brussel sprouts at 229–316 ([Cao, Sofic, & Prior, 1996](#)).

Several studies have examined the impact of health information on consumer choice using other analytical models. [Ginon, Lohéac, Martin, Combris, and Issanchou \(2009\)](#) assessed the impact of label information about fiber content and general information about the long-term health benefits of fiber on the price consumers were willing-to-pay for baguettes. The study revealed that label information had a positive effect on price, though this effect was only observed when the baguette received high hedonic scores. [Baixauli, Salvador, Hough, and Fiszman \(2008\)](#) explored the effect of information about fiber on consumer acceptance and purchase intent measured on 9-point scales using an advanced ANOVA technique for plain, whole meal, and fiber-enriched muffins. Fiber information did not have a significant effect on purchase intent for plain and fiber-enriched muffins, but did have a significant effect on whole meal muffins. A purchase intent scale for a new fat spread with a proven health benefit was compared to an established spread in a study by [Bower, Saadat, and Whitten \(2003\)](#). Information about the health benefits of the new fat spread had a significant effect on purchase intent, especially when combined with high hedonic scores. Each of these studies produces useful information about factors which have significant effects on purchase intent, but they do not provide the marginal impacts of each explanatory factor on the probability of purchase.

2. Materials and methods

2.1. Materials, participants, and test procedure

Data for this analysis was collected as part of a consumer test to evaluate new varieties of specialty potatoes. A standard multiple-sample approach was used. All participants were recruited from a list of consumers living in the greater Portland metropolitan area provided by the Oregon State University Food Innovation Center where the consumer test was conducted. Participants were contacted by e-mail to take the online screener. Screener questions included usage questions about three vegetables to reduce focus on the potatoes, and included demographic and scheduling information. The screener asked potential participants a variety of questions regarding their liking, usage, and purchase of three vegetables, as well as four Likert scale questions to assess their attitudes on health and food. Questions regarding the consumption and use of squash and greens as well as of potatoes were asked in order to distract the potential participants from realizing the intent of the test and therefore falsifying their answers in order to qualify for the test. Participants were compensated \$35 for their involvement in the study. Further details on the screener process are available in ([Wechsler, 2010](#)); participant selection is discussed with their related variables in Section 2.4.

Participants tested samples in one of 10 partitioned taste test booths equipped with computers and touch screen monitors. Participant data was collected using Compusense Five (Version 5.0, Guelph, Ontario). Each consumer tested four potato varieties (two yellow fleshed, one red fleshed, and one purple fleshed) drawn from six new varieties and one commonly available variety. The groupings are shown in [Table 1](#) which also provides details on the raw appearance of the varieties tested as well as the clone number and market name if known. One of the four tested by a consumer was always the commonly available yellow fleshed and skinned variety Yukon Gold, which provided a baseline for the sensory testing. Thus, though seven different varieties were

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