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Towards Consumer–Oriented Mushroom–Based Product Development: An Exploratory Study in Rice–Based Farming Communities in Central Luzon, Philippines

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ABSTRACT

This study determined consumers' awareness and interest towards mushroom and mushroom-based product ideas. A survey of 222 adults was conducted in rice-based farming communities in selected provinces, namely, Aurora, Bulacan, Nueva Ecija, and Pampanga. Results showed that taste, nutritional, and health benefits were the top attributes considered by both sexes whenever they buy food for household consumption. Most of the respondents (99%) liked eating mushroom because of its palatability (71%) and perceived healthiness (26%). However, the majority (76%) consumed mushroom only once a month or seldom in a year due to its limited availability. Food supplements, coffee-like beverages, and snacks (bread, chips, cookies) were the most interesting mushroom-based product ideas. These findings suggest product development opportunities and strategies to increase utilization and encourage mushroom cultivation in Central Luzon.

Keywords: *consumer interest, market survey, mushroom, mushroom-based products*

Introduction

In the Philippines, where rice farming is a common source of income in rural communities, value-adding of other agricultural crops is a key strategy identified to provide additional livelihood sources. Mushroom production is promoted in the country due to its exceptional quality as food, its profitability potential, and its opportunities to improve sustainability in rice farms. Government initiatives on the mushroom industry in Central Luzon started in 2004, seeing that mushroom has a huge potential as a source of supplemental income. Central Luzon has a hot and humid climate that is suitable for mushroom cultivation. Additionally, it is a rice-producing region that produces high amounts of agricultural waste such as rice straw and rice hull that can serve as substrates in mushroom propagation. Strong government support can be observed in the form of production and processing trainings (Flora 2020), funding (Bombom 2019), provision of planting materials, and establishment of Research and Development

(R&D) facilities focusing on mushroom (i.e., Center for Tropical Mushroom Research and Development [CTMRD] and Central Luzon Integrated Agricultural Research Center [CLIARC] for Lowland Development) (Flora 2020, Tecson 2020). Alongside efforts to increase production, by-product utilization and mushroom processing are

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also being encouraged (Flora 2020). Recently, the Philippine Rice Research Institute (PhilRice) joined in promoting mushroom production and mushroom-based enterprises as an additional source of income and as a means to utilize farming by-products such as rice straw through the *Palayamanan Plus* Program.

Mushroom is rich in protein, dietary fiber, minerals, and vitamins. It has extensive health-promoting properties known to be useful in preventing non-communicable diseases such as diabetes, hypercholesterolemia, and heart diseases (Gupta *et al.* 2018, Ho *et al.* 2020). Its antimicrobial properties are also notable. Discoveries that mushroom has anti-Alzheimer and anti-HIV components are very promising in medicinal applications (Dulay, Ray, and Hou 2015, Zhang *et al.* 2014). On top of these, mushroom production is a profitable business enterprise. Although mushroom production is labor-intensive, mushroom can easily be grown in any place as long as optimum growth condition is provided (Corales *et al.* 2014). It is known to provide high and fast income to farmers and entrepreneurs, which is attributed to its high market demand, low cost of inputs, and fast-growing characteristic (Chang *et al.* 2014, Corales *et al.* 2018, The Daily Guardian 2018).

Despite the high demand for mushrooms, losses are still prominent due to poor market accessibility and market inefficiencies (e.g., market chain is not well established), which have implications on mushroom's perishable nature (Chang *et al.* 2014, Wakchaure *et al.* 2010). Mushrooms can only last up to three days after being harvested (Singh, Sindhu, and Sindhu 2016). This problem can be addressed through value-adding activities, such as development of mushroom-based food products (e.g., seasoning, noodles, soup mixture). Value-adding is observed to increase mushroom products' profitability from 30% to 70% (Business Diary 2018, Wakchaure *et al.* 2010).

Hence, this study was conducted to determine consumers' liking and behavior toward fresh mushrooms and assess consumers' interest in some pre-identified mushroom-based product ideas and to explore and ensure consumer-focused mushroom processing and other mushroom-based enterprise opportunities. In addition, the information will guide product developers and technology generators from the science community and the food industry, both from public and private sectors, who are interested in processing, development, and marketing of products made from mushroom in Central Luzon, Philippines.

Conceptual Framework

The following conceptual framework presents the first stage of the new product development strategy, which has served as a guide in looking for mushroom-based product development opportunities (see Figure 1). This framework is derived from the consumer-led new product development (NPD) concept (Costa and Jongen 2006, Kotler and Armstrong 2018, Linnemann *et al.* 2006) and the conversion funnel (Niemand *et al.* 2020). The consumer-led new product development is a market-oriented strategy to develop new products, which complements technical knowledge with market information (Santoro, Vrontis, and Pastore 2017). The process is presented in different ways, but the one that emphasizes consumer-orientation is from Costa and Jongen (2006), which starts from opportunity identification, product design, testing, and introduction to life cycle management. Consumer-led NPD strategy has been applied to various products, primarily in the food and beverages industry (Santoro, Vrontis, and Pastore 2017), particularly innovations in traditional foods and functional foods (Guiné *et al.* 2020). Halargarda (2017) explained how essential it is to know consumer needs through consumer research. It was found out that there is a gap in consumer satisfaction in the market of bakery savory snacks, which eventually served as an opportunity for new product development.

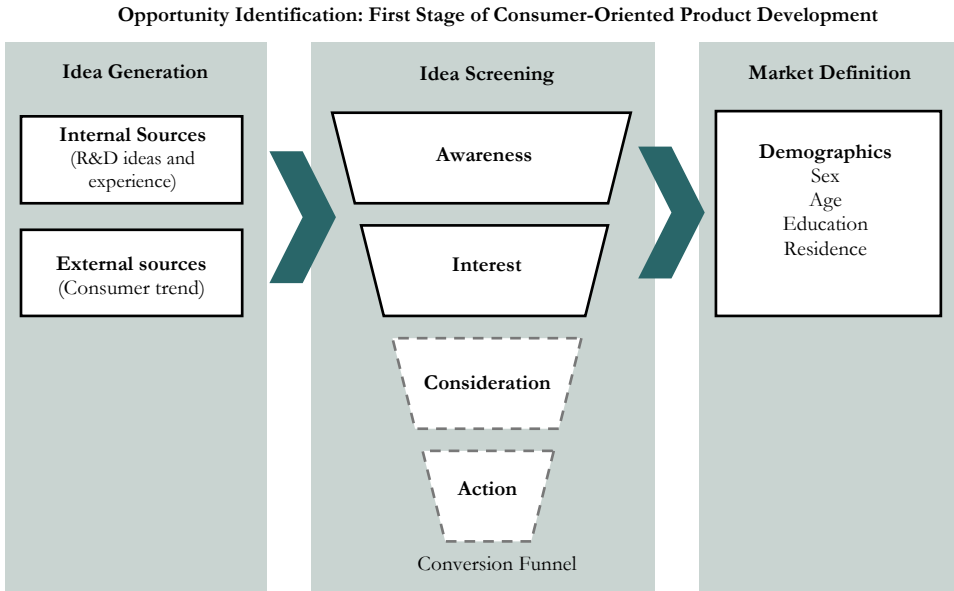


Figure 1. Conceptual framework for consumer-oriented mushroom-based product development at the opportunity identification stage

This study focuses on the “opportunity identification” stage, which has three component stages – idea generation, idea screening, and market identification. During idea generation, product ideas are derived from internal and external sources. Internal sources of ideas come from the organization or company’s own people, such as the executives, marketing staff, engineers, manufacturing staff, and R&D staff. External sources of ideas are the company’s distributors, suppliers, competitors, and consumers (Kotler and Armstrong 2018). As for public government agencies or research institutes, these include fellow agencies or research institutes, private organizations and individuals, and R&D program recipients.

Idea screening is the stage that picks out product ideas and drops the poor ideas as soon as possible to proceed to those ideas that will likely turn into profitable products (Kotler and Armstrong 2018). In this study, the conversion funnel is used to evaluate product ideas in this idea screening stage. The conversion funnel, also called the buying funnel, shows the decision-making process undergone by consumers from the awareness to the action stage. This conversion funnel primarily models how promotional efforts (e.g., advertising) affect the conversion of consumers (prospects) into customers (purchasers) of products (Jansen and Schuster 2011, Niemand *et al.* 2020). The first phase is the awareness phase that is when consumers realize their needs and explore options to satisfy these needs with a product or service. Next, the interest phase is manifested when consumers make use of information to address their needs, such as searching for the correct product. The last two phases are not covered in this study but are briefly explained as follows – the consideration phase is when consumers consider a set of options for evaluation and comparison, and the final phase is the action phase when consumers become customers and have made the decision to purchase (Jansen and Schuster 2011, Niemand *et al.* 2020, Sergeev and Kirillova 2019).

While the application of the conversion funnel in the literature is typically about determining the effectiveness of advertising tools towards consumer-to-customer conversion (Jansen and Schuster 2011, Niemand *et al.* 2020, Sergeev and Kirillova 2019), this study would make use of the decision-making process of the consumers along the funnel to screen product ideas. Awareness is measured by their awareness of fresh mushroom, and interest is directly measured by their interest level on the different mushroom-based product ideas.

Lastly, the market definition stage aims at identifying the target market where this new product development venture can be profitable (Costa and Jongen 2006). The market would be explored through demographic variables to define some specific groups where the products are suited based on their level of interest toward mushroom-based product ideas.

Methodology

Mushroom-based Product Idea Generation

Product ideas were collected through literature search (e.g., journal articles, news articles about the government's mushroom program). The selection of product ideas to be included in the study was based on consumer trends (i.e., consumption on consumer goods) indicated by national (Nielsen 2014a, Nielsen 2014b, Nielsen 2017) and regional (i.e., Central Luzon) (Ballesteros and Abilgos-Ramos 2018) market research results and plausibility of the product as judged by the product developers in this study based on their product development activities and experience, and observation on the availability of the product in the market. New product development includes the development of novel products and innovation or improvement of existing products (Kotler and Armstrong 2018).

Data Collection

Survey participants were chosen through the purposive sampling method with the following criteria of selection: (1) residents of a rice-based farming community in Nueva Ecija, Aurora, Pampanga, and Bulacan, (2) had eaten mushroom, and (3) 15 years old and above. A total of 222 adult respondents (age \geq 18 years old) were selected from these sites.

A questionnaire was first developed consisting of two parts: socio-demographic questions and consumers' attitudes toward mushroom and interest in pre-selected mushroom-based product ideas. The questionnaire was pre-tested and then explained to the respondents before it was distributed for filling out. Respondents were asked to rate the importance of product attributes when deciding what product to buy using five-point Likert-type scores: 1-very unimportant, 2-unimportant, 3-neither important nor unimportant, 4-important, and 5-very important. Likewise, interest in different mushroom-based product ideas was scored with 1-very uninteresting, 2-uninteresting, 3-neither interesting nor uninteresting, 4-interesting, and 5-very interesting.

Data analysis

Data were encoded in MS Excel 2013. Descriptive statistics were employed to analyze the data through IBM SPSS version 20. Mode, frequencies, percentage distribution, and interquartile range (IQR) were used to characterize the consumers and their attitude and behavior toward fresh mushroom and interest in mushroom-based product ideas. IQR was specifically used to determine how dispersed the respondents' rating scores were on product attribute importance. Relative Importance Index (RII) (Somiah, Osei-Poku, and Aidoo 2015) was used to rank the importance of attributes. Consumers' interest in the mushroom-based product ideas was presented using percentage distribution between the top-two and bottom-three interest scores. Chi-square test of independence analysis was also used to determine the association between consumers' interest in pre-identified mushroom-based product ideas and their socio-demographic characteristics. Although the chi-square test assumes that the sample to be analyzed was drawn out from probability sampling methods, inferential statistics like chi-square are still used in probability sample data as stated by McHugh (2013).

It has been a gold standard for the generalization of (statistical) results that samples are random, drawn from probability sampling techniques (Tipton *et al.* 2016). Since this study performed a non-random sampling technique, the results can be biased, and the validity of findings and conclusions are limited only to the samples under the study. Nevertheless, some

statisticians nowadays have presented the relevance of nonrandom samples (i.e., purposive and convenience) and how they could lead to robust findings when compared with similar studies or over time through replication (Hubbard *et al.* 2019).

Results and Discussion

Socio-demographic Profile of the Respondents

Of the 222 respondents surveyed, 50.9% were females and the mean age was 46 years old. More than a third of the respondents came from the Palayamanan Plus sites in Nueva Ecija (36.9%) and Aurora (36.5%), while 14.0% came from Pampanga and 12.6% from Bulacan. More than half of the respondents were married (64.8%). The highest percentage of respondents reached high school level (41.6%) and were farmers (39.6%). The per capita monthly income of respondents who provided information in this section (n=195) was PHP 6,114.23.

Of the 222 respondents interviewed, 63.1% stated that they were the ones who decide what food to buy for their household consumption, while 6.8% shared the decision-making with other family members. Females (60.5%) were the prominent household decision-makers on household consumption, highlighting the roles of wives or mothers. The common norm in Filipino households is that the husband and the wife make joint decisions on how to spend their income. Castro (2014) elaborated in his study that generally, the husband and the wife decide together on how to spend the husband's income (61%) and the wife's income (51%). However, decisions on food, together with clothing and child nurturing, usually come from the wives or mothers (David 1994, Castro 2014).

Consumer Liking and Behavior Towards the Fresh Mushroom

The main crops grown in the sites were rice (47.1%), corn (6.6%), and various vegetables. These vegetables included eggplant (7.4%), *pechay* (4.8%), and tomato (3.7%), which were among the commonly grown crops in the backyard of Filipinos. Mushroom, however, was mentioned by only one of the 222 respondents (0.3%). This could indicate scarce supply or limited availability of mushrooms in these areas. These findings could further imply that these main crops are the readily available food for consumption, except mushrooms. Despite that, rice-based communities still pose an opportunity in mushroom production since the rice straw, a by-product of rice used in growing mushroom, has been abundant in these areas. Additionally, the Department of Agriculture Regional Field Office III (DA-RFO III) is recently implementing a project to mass propagate quality mushroom planting materials that would eventually boost mushroom production in the region (Tecson 2020), which is aimed at providing opportunities for agri-based livelihoods to the farmers.

Although mushroom is not regularly available, consumers in rice-based farming communities have expressed their liking towards the mushroom. Almost all the respondents (99.1%) said that they liked eating the mushroom, and the common reasons why they liked it was it being delicious and tasty (70.9%) and healthy (26.2%) (see Table 1). These were also the main reasons why they would recommend it to others. The taste of the mushroom enjoyed by most respondents could be attributed to its flavor-enhancing properties, such as the umami taste and glutamic acid, aspartic acid, and 50-ribonucleotides (Guinard *et al.* 2016). Mushroom proteins contain amino acids similar to those of animal proteins; hence, mushroom tastes like meat and is considered a good substitute for the latter (Julian, Reyes, and Eguchi 2018). Apart from its desirable taste, mushroom is well-known for its nutritional content and health benefits. Mushroom is an excellent source of vitamins (B1, B2, B12, C, D, and E), minerals (potassium, iron, copper, zinc, manganese), and health-promoting compounds (unsaturated fatty acids, phenolic compounds, tocopherols, ascorbic acid, carotenoids) (Gupta *et al.* 2018). Mushroom is also widely promoted as an additional livelihood source in rural areas because

of its high profitability, the availability of inexpensive production inputs (e.g., agricultural wastes), and that the favorable growth condition can be easily obtained (Gupta *et al.* 2018). In fact, success stories of local farmers and entrepreneurs on mushroom business have already been published online (Cardiñoza 2015, Lazaro 2018).

Table 1. Respondent's liking towards mushroom and reasons for liking

Item	Frequency (<i>n</i> = 222)	Percentage Distribution
Do you like mushroom?		
Yes	220	99.09
No	2	0.90
What are your reasons for liking mushroom? *		
Delicious/Tasty	149	61.57
Healthy	71	29.34
Substitute to meat	4	1.65
To earn profit	1	0.41
It's rare	1	0.41
No response	16	6.61
Would you recommend mushroom to others?		
Yes	210	94.59
No	9	4.05
No response	3	1.35
What are your reasons to recommend? *		
Delicious	84	44.44
Healthy	55	29.10
For others to taste	26	13.76
Possible source of additional income	14	7.41
It's rare	9	4.76
Can be used as substitute/alternative to meat	1	0.53
No response	33	14.86

Note: *Multiple responses

In terms of behavior towards mushroom, all respondents in rice-based farming sites have consumed mushroom. However, the frequency of consumption of mushroom in the test sites is low, with only 23.9% consuming it once and twice a week (see Table 2). They usually consumed mushroom through dishes such as *pancit* with mushroom, sautéed mushroom, stir-fried mushroom with other vegetables, *bulanglang*, and soup with mushroom (*nilagang* mushroom). Sautéing/stir-frying (*guisado*) and boiling/stewing (*nilaga*) are common Filipino cooking methods (Castillo-Carandang *et al.* 2014). These results also present an opportunity for culinary experts and nutritionists to develop and disseminate innovative, inexpensive, and easy-to-prepare food preparations using locally available mushrooms, combining them with the other local crops, which would meet the farming communities' needs and wants and deliver their nutrient requirements.

Table 2. Consumption behavior of respondents towards mushroom

Item	Frequency (<i>n</i> = 222)	Percentage Distribution
Do you eat mushroom?		
Yes	220	100
No	2	0.90
How often do you consume mushroom dishes/products?		
Once a month	88	39.64
Whenever available/seldom in a year	81	36.49
Once a week	33	14.86
Twice a week	20	9.01
No response	2	0.90

Table 2. Continued...

How do you usually eat mushroom?*		
<i>Pancit</i> with mushroom	22	12.02
Sautéed	22	12.02
Stir-fried with other vegetables (e.g., <i>ampalaya</i>)	19	10.38
<i>Bulanglang</i>	13	7.10
Soup with mushroom	13	7.10
Fried mushroom	9	4.92
Spaghetti with mushroom bits	9	4.92
<i>Torta</i>	9	4.92
<i>Misua</i> with mushroom	8	4.37
<i>Binayabasan</i>	6	3.28
<i>Binagoongan</i>	6	3.28
<i>Pinakbet</i>	6	3.28
<i>Sisig</i>	5	2.73
Tempura	5	2.73
<i>Dinengdeng</i>	4	2.19
<i>Abrav</i>	3	1.64
Arroz caldo with mushroom	3	1.64
Mushroom patty	3	1.64
<i>Sinigang</i>	3	1.64
<i>Siomai</i>	3	1.64
Chips	2	1.09
Beef and mushroom	1	0.55
<i>Chicharon</i>	1	0.55
Chili mushroom	1	0.55
Cookies	1	0.55
Grilled mushroom	1	0.55
Mungbean with mushroom	1	0.55
Mushroom <i>Dinakdakan</i>	1	0.55
<i>Pinapaitan</i>	1	0.55
<i>Sinampalukan</i>	1	0.55
Tuna mushroom	1	0.55
No response	44	23.11

Note: *Multiple responses

Despite the limited availability of mushroom as supported by the less frequent mushroom consumption, consumers still exhibited liking and behavior on mushroom. Increasing the production by technological improvement and enhancing the marketing (e.g., value chain) of mushroom could therefore meet the growing demand for mushrooms in these areas (Chang *et al.* 2014).

Food Product Attributes Considered by Consumers as Important When Making Purchase Decisions

Consumer wishes can be translated into food characteristics and attributes (e.g., healthy, quality, price, taste, convenience, the appearance of food) which are known factors that influence consumers' food choice (Sijtsema *et al.* 2002). This is clearly demonstrated by Gains (1994) model showing that food choice is affected by the interaction between the food itself, consumer characteristics, and context of where the interaction takes place (Gains 1994, Sijtsema *et al.* 2002). Thus, this study also tried to explore the food product attributes that the consumers considered important and that may have influenced their current food-related behavior. The knowledge would play a role in consumer-oriented product development, such as focusing on gauging which attributes to prioritize (Sijtsema *et al.*, 2002). This study, likewise,

explored gender differences in their importance ratings because men and women are known to have differences in their food choice (Manippa *et al.* 2017, Wardle *et al.* 2004).

Most of the male and female respondents rated the attributes presented with the top two scores (4 or “important” and 5 or “very important”). They scored the attributes usually at 5 or “very important”. The IQR was from zero to one, which further validated that each attribute was closely rated by the respondents (see Table 3). Through the computed RII, it was found out that the top three most important attributes for male respondents were nutritional and health benefits, taste, and aroma. The top three most important attributes for females were taste, nutritional and health benefits, and appearance. Taste is known to be the number one factor that affects consumers’ food choices. In addition, taste plays a functional role as it indicates the nutritional properties of the food as well (McCrickerd and Forde 2015). However, it is interesting that nutritional and health benefits ranked as the first-choice criterion for male respondents and second for female respondents (see Table 3). Women are typically more health-conscious, who would check more on nutrition and health information in product labels and would likely buy food products that offer better nutritional and health quality than men (Glorioso *et al.* 2018, Missagia, De Oliveira, and de Rezende 2012). However, men also have a health motive in making food choices. They like to consume food that is good for their health, but most of the time, this remains to be just a motive or a concept in mind (Missagia, De Oliveira, and de Rezende 2012). In this study, no conclusive gender difference can be inferred from the importance rating of different attributes. Male and female respondents closely scored the attributes from 4 or “important” to 5 or “very important.” Appearance and aroma are also vital attributes. Appearance is usually the first to stimulate a person's appetite because it triggers a person's belief or experience. The aroma is also another important attribute, especially to flavor perception on food (McCrickerd and Forde 2015).

Table 3. Respondents’ perceived importance toward different product attributes

Attribute	Interquartile Range		Relative Importance Index			
	Male	Female	Male	Rank	Female	Rank
Taste	1	0	0.89	2	0.95	1
Nutritional and health benefits	1	0	0.89	1	0.94	2
Aroma	1	1	0.88	3	0.92	4
Appearance	1	1	0.86	5	0.93	3
Price	1	1	0.87	4	0.92	5
Texture	1	1	0.86	6	0.92	5
Packaging	1	1	0.84	7	0.89	6
Color	1	1	0.84	7	0.89	7

Notes: Mode of scores = 5; n = 222

Opportunities for Consumer-Led Mushroom-Based Product Development

Idea Generation

As stated in the conceptual framework, a consumer-led NPD starts with idea generation using external and internal sources. Product ideas should anchor to consumer needs while complementing them with product developers' technical knowledge or capacity. Literature search through journal articles, news articles, consumer trends, and product developers' deliberation based on their decision on their own R&D observation and experience led to the following mushroom product ideas. These product ideas could also be found in the following articles that demonstrated their potential to be developed. These include food supplement (Patel, Naraiian, and Singh 2012, Kakon, Choudhury, and Saha 2012, Rathore, Prasad, and Sharma 2017), coffee-like beverage, chips (Domingo 2020), bread and cake (Gaglio *et al.* 2018, Yuan *et al.* 2017), cookies (Wakchaure *et al.* 2010), sauce (Ho, Asyikeen Zulkifli and Tan 2020), ice cream (Tsai *et al.* 2020), preserves (Wakchaure *et al.* 2010), yogurt (Antonteceva *et al.* 2019, Bouzgarrou *et al.* 2018, Chou, Sheih, and Fang 2013), shake and drink (Mongkontanwat and Phuangborisut 2019).

Idea Screening and the Conversion Funnel

In the idea screening stage, the conversion funnel model was used to evaluate and screen product ideas based on consumer awareness and interest. Awareness is the first stage of the funnel where consumers are aware of their needs and are exploring options to satisfy these needs. In this study, consumers were all aware of fresh mushrooms and had eaten at least once before. In fact, they were also able to recognize species of mushroom that were sometimes grown in their locality, which include straw (38.52%), oyster (34.63%), wood ear (19.07%), milky (3.89%), and button (1.56%) mushrooms. These are common species grown in the Philippines (Corales *et al.* 2018). This awareness and consumption of mushrooms may entail that consumers in these rice-based communities, based on the conversion funnel, had previously recognized some need or desire for mushroom; therefore, they could be considered as leads or prospect consumers (broader target market) of future mushroom-based products. However, awareness for each mushroom product idea was not covered in this study. Thus, product ideas could not be screened based on awareness. Nevertheless, it can be noted that mushroom-based product ideas such as chips and cookies would likely be familiar among consumers in Central Luzon due to previous product development initiatives, or a product of local enterprises (e.g., *pasalubong* centers), or as product presented in food expo (Business Diary 2018, Cardínoza 2015, Dizon 2020).

The next stage of the conversion funnel is the interest stage, where consumers would search for and express interest in some information or product. Most male and female respondents (72-95%, mode = 4) stated they were interested in all mushroom-based product ideas. They rated the product ideas mostly with the top-two rating, 4 or "interested" to 5 or "very interested." Only a few (10-28%) were "neither interested nor uninterested," "uninterested," and "very uninterested" in these product concepts. The IQR analysis indicated which product ideas were given most with the top-two interest rating, and these were food supplements, coffee-like beverages, chips, bread, and cookies for both genders (see Figure 2). As a food supplement or ingredient of food supplement, mushroom is widely promoted as a food that is rich in nutrients and health benefits. Many studies showed the promising potential of mushrooms as a source of natural ingredients for nutraceutical, functional, and medical applications. For example, button mushroom has antioxidants, hypolipidemic agents, anti-diabetic, immunomodulating, antitumor, and anticancer properties (Julian, Reyes, and Eguchi 2018). Oyster mushroom demonstrates antilipidemic, antihyperglycemic, cholesterol-lowering, and blood sugar level-lowering properties (Julian, Reyes, and Eguchi 2018). In addition, regular intake of mushroom extracts and other nutraceuticals exhibited very low toxicity compared to medicinal drugs (Soković *et al.* 2018). This fact might have pulled respondents' interest on mushroom-based food supplements, giving credence to the notion that Filipino consumers, at least from Central Luzon, tend to be more health-conscious and are looking for safe alternatives for disease prevention. There are already dietary supplements that are produced using mushroom species as ingredients. The attributes mentioned above led to the development of products that utilize mushroom's health-promoting properties. Reis *et al.* (2017) reviewed and listed nutraceutical products available in the market worldwide, which use various mushroom species as ingredients. As claimed by the manufacturers, these products would help maintain the immune system's health, general well-being, relief from allergies, cough, arthritis, and influenza, heart health, normalization of cholesterol and blood sugar levels, and many others.

There are gender differences in food choices, which this study also tried to explore. In terms of the coffee-like mushroom-based beverage, both men and women respondents indicated positive interest in this idea (see Figure 2). Most Filipinos, men and women alike, are coffee drinkers. In fact, instant coffee is the most consumed beverage in the country. It belongs to the top 20 food consumed by Filipino households based on the 2015 household consumption survey (Gavilan 2015).

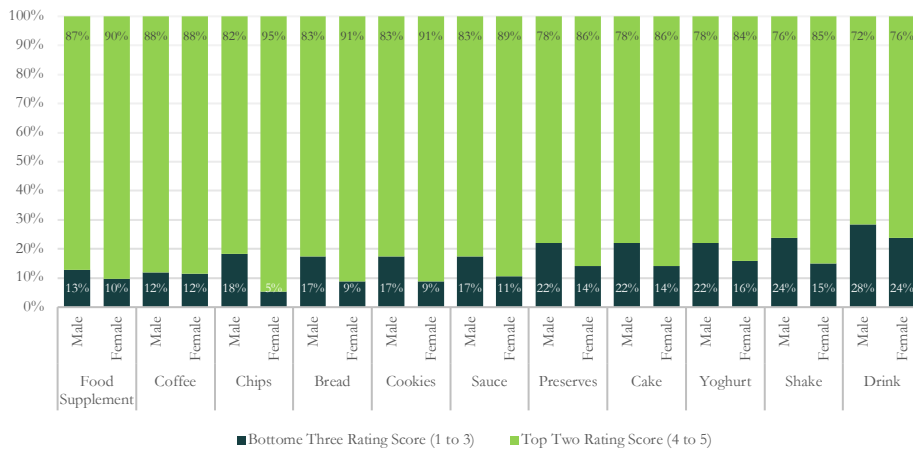


Figure 2. Respondents' interest toward different mushroom-based product ideas

Mushroom-based bakery product ideas such as bread, cookies, and chips gained the highest interest scores from the respondents. According to a local market study, these bakery products were among the most frequently purchased snack food of consumers from the same region (Ballesteros and Abilgos-Ramos 2018). This suggests why respondents also preferred mushroom-based bakery products among other pre-identified product ideas. However, mushroom-based cookies and chips are not new and are already existing in some places. Government agencies assisted some local micro or small enterprises to venture on mushroom value-added products. However, there is not much information about the production, availability, and marketing of mushroom-based bread or cake in the country, providing product developers and entrepreneurs an opportunity to intensify activities related to these aspects.

Association Between Consumers' Interest in Mushroom-Based Product Ideas and Their Sociodemographic Characteristics

Demographic characteristics (e.g., age, gender, education) are known factors that influence consumer intention to try or purchase new food products and functional foods, and mushroom has been widely recognized in the literature as a functional food or food ingredient (Guiné *et. al.* 2020). This study focused on consumer interest, which is only one of the aspects of a broader concept of consumer attitude and may not be enough to predict future consumer behavior. Nevertheless, the interest of consumers, as discussed by the conversion funnel model, will ultimately be converted to intention and actual purchase of actual products by using the appropriate strategies. The last phase of the opportunity identification stage of the consumer-led NPD is the market definition, which was done by exploring the association of consumer's interest in mushroom-based product ideas and demographic variables (see Table 4). No significant association was found between consumers' interest in mushroom-based product ideas and the sex of consumers, except for mushroom chips ($\chi^2 = 9.12, p < 0.05$), which is significantly associated with female consumers. This agrees with Nielsen's market study (2014a), which found out that women tend to eat more snacks globally than men. Snacking is a common habit for Filipinos (Nielsen 2014b), and chips are a usual snack in the country, according to a local market study (Adobo Magazine 2017). There was also no significant association found between consumers' interest and their age.

Table 4. Association between respondents' interest on mushroom-based product ideas and their sex and age

	Sex		χ^2	Age		χ^2
	Female (<i>n</i> = 113)	Male (<i>n</i> = 109)		15-40 (<i>n</i> = 76)	40+ (<i>n</i> = 146)	
Food Supplement						
T2	90.2	87.2	0.537	85.5	90.4	1.193
B3	9.7	12.8		14.5	9.6	
Coffee						
T2	88.5	88.1	0.01	82.9	91.1	3.251
B3	11.5	11.9		17.1	8.9	
Chips						
T2	94.7	81.6	9.122*	94.7	84.9	4.647
B3	5.3	18.4		5.3	15.1	
Bread						
T2	91.2	82.6	3.598	84.2	88.4	0.756
B3	8.8	17.4		15.8	11.6	
Cookies						
T2	17.4	82.6	3.592	88.2	86.3	0.152
B3	8.8	91.2		11.8	13.7	
Sauce						
T2	89.4	82.6	2.143	88.2	84.9	0.433
B3	10.6	17.4		11.8	15.1	
Ice Cream						
T2	88.5	82.6	1.58	90.8	82.9	2.527
B3	11.5	17.4		9.2	17.1	
Preserves						
T2	85.8	78	2.32	81.6	82.2	0.013
B3	14.2	22		18.4	17.8	
Cake						
T2	85.8	78	2.32	77.6	84.2	1.481
B3	14.2	22		22.4	15.8	
Yogurt						
T2	84.1	78	1.324	86.8	78.1	2.500
B3	15.9	22		13.5	21.9	
Shake						
T2	85	76.2		81.6	80.1	0.067
B3	15	23.8	2.757	18.4	19.9	
Drink						
T2	76.1	71.6	0.594	75	73.3	0.076
B3	23.9	28.4		25	26.7	

Notes: T2- Top 2 rates; B3-Bottom 3 rates

*statistically significant at $p < 0.05$

Between education and consumers' interest on product ideas, there is a significant association between not having college degrees with interest on mushroom-based food supplement ($\chi^2 = 5.76, p < 0.05$), coffee ($\chi^2 = 9.74, p < 0.05$), bread ($\chi^2 = 9.4, p < 0.05$), sauce ($\chi^2 = 5.04, p < 0.05$), cake ($\chi^2 = 13.03, p < 0.001$), and drink ($\chi^2 = 5.30, p < 0.05$) (see Table 5). The finding on consumer interest in mushroom-based food supplements is supported by the results of a local study on awareness, perception, and usage of dietary supplement conducted in 1998. It showed that there were more sporadic and regular users of dietary supplements among high school graduates than college graduates (Cruz and Tanchoco 2000). Apparently, this situation did not change for the past 10 years, as more users of dietary supplements were counted among respondents with low educational attainment (\leq college level) than those with higher educational attainment (Cruz, Tanchoco, and Orense 2011). Individuals with low educational attainment are usually employed in intensive labor work or unskilled work, which requires more energy. Coffee, bread, cake, and drinks usually have high calories, which are normally served as snacks to Filipino consumers.

Some significant associations were also noted between consumers' interest and place of residence (see Table 5). Mushroom-based preserves ($\chi^2 = 24.23, p < 0.001$), cake ($\chi^2 = 30.23, p < 0.001$), yoghurt ($\chi^2 = 25.55, p < 0.001$), shake ($\chi^2 = 23.79, p < 0.001$), and drink ($\chi^2 = 40.12, p < 0.001$), seemed to be more interesting for respondents from Aurora and Bulacan compared to those from Nueva Ecija and Pampanga. It could be that mushroom production and

processing were vigorously promoted and supported by different government agencies in Nueva Ecija and Pampanga than in other Central Luzon provinces. Articles of farmers or entrepreneurs encouraged to engage in mushroom processing in Nueva Ecija and Pampanga were published online (Central Luzon 2011, Flora 2010, Flora 2015). Mushroom-based products might have already been introduced to consumers in these areas, while some consumers in Aurora and Bulacan might be unfamiliar with mushroom-based products. Filipinos are considered to be among the “world’s most curious consumers” and are willing to try new product offerings (PANA 2015). However, this market insight must be taken with caution since Filipinos are also known to have strong brand loyalty. They usually try new products which come from familiar brands (Rappler 2015). On the positive side, Filipinos recently exhibited a higher preference toward locally made biscuits, chips, snacks, and cookies than global brands (Nielsen 2017). Further studies are needed to determine specific reasons for the high level of interest in the said product ideas among consumers from Aurora and Bulacan.

Table 5. Association between respondents’ interest on mushroom-based product ideas and their education, and place of residence

	Education		χ^2	Residence				χ^2
	Non-degree (<i>n</i> = 113)	Degree (<i>n</i> = 69)		NE (<i>n</i> = 82)	Aurora (<i>n</i> =81)	Pampanga (<i>n</i> =31)	Bulacan (<i>n</i> =28)	
Food Supplement								
T2	92.2	81.2	5.755*	84.2	98.8	71	92.9	20.152
B3	7.8	18.8		15.82	1.2	29	7.1	
Coffee								
T2	92.8	78.3	9.736*	81.7	98.8	67.7	100	28.404
B3	7.2	21.7		18.3	1.2	32.3	0	
Chips								
T2	89.5	85.5	0.749*	84.2	97.5	67.7	96.4	22.503
B3	10.5	14.5		15.8	2.5	32.3	3.6	
Bread								
T2	91.5	76.8	9.038*	80.5	97.5	67.7	96.4	23.287
B3	8.5	23.2		19.5	2.5	32.3	3.6	
Cookies								
T2	89.5	81.2	2.943	80.5	97.5	67.7	96.4	23.287
B3	10.5	18.8		19.5	2.5	32.3	3.6	
Sauce								
T2	89.5	78.3	5.038*	81.7	96.3	64.5	92.9	21.411
B3	10.5	21.7		18.3	3.7	35.5	7.1	
Ice Cream								
T2	86.3	84.1	0.189	79.3	97.5	64.5	92.9	24.376
B3	13.7	15.9		20.7	2.5	35.5	7.1	
Preserves								
T2	84.3	76.8	1.812	72	96.3	64.5	89.3	24.234**
B3	15.7	23.2		28	3.7	35.4	10.7	
Cake								
T2	88.2	68.1	13.031**	69.5	96.3	64.5	96.4	30.226**
B3	11.8	31.9		30.5	3.7	35.5	3.6	
Yogurt								
T2	83.7	75.4	2.135	69.5	95.1	64.5	92.9	25.552**
B3	16.3	24.6		30.5	4.9	35.5	7.1	
Shake								
T2	83.7	73.9	2.893	69.5	95.1	64.5	89.3	23.789**
B3	16.3	26.1		30.5	4.9	35.5	10.7	
Drink								
T2	78.4	63.8	5.298*	56.1	95.1	54.8	85.7	40.120**
B3	21.6	36.2		43.9	4.9	45.5	14.3	

Notes: T2- Top 2 rates; B3-Bottom 3 rates

*,**statistically significant at $p < 0.05$ and $p < 0.001$, respectively

Conclusions and Recommendations

Consumers from rice-based farming communities in selected provinces in Central Luzon expressed their liking towards fresh mushrooms as food. They were highly interested in the pre-identified mushroom-based product ideas, especially food supplements, coffee-like beverages, and snack food (e.g., bread, cookie, chip, cake). Many studies have been conducted to explore the functional properties of mushrooms for the development of food supplements and functional foods; thus, a thorough review should be conducted to find gaps that will serve as an entry for innovation towards better nutrition, health, and safety. Even though mushroom-based cookies and chips are not novel, these product ideas still captured the interest of consumers from the abovementioned provinces, which suggests that improvement in the products can still be made, such as combining it with other locally grown crops that are also known to be nutritious and healthy. Mushroom-based bakery products such as bread and cake could also be explored since these products are uncommon in the country. Coffee-like mushroom beverages could also be developed. Future product development research should consider that each product might require different varieties of mushrooms. The next stage should be to elaborate these interesting product ideas into more detailed product concepts considering who will be the target market (e.g., target consumer segment), what would be the product features, unique characteristics or value-added attributes that will be offered, and product value (i.e., pricing). A concept testing or product acceptance studies could also be done, using product prototypes to know which product concepts have strong consumer appeal and will undergo further product development.

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