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The Development and Promotion of Sweet Potato Yoghurt in Ghana: Implications for Sustainable Production and Consumption Policies

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Abstract: This paper analyzes how a newly developed food product (potagurt) with nutritional and health benefits can be promoted in Ghana. We employ the hedonic modeling and contingent valuation methods to estimate monetary values attached to the product's attributes using 400 consumers in the Ashanti, Eastern, and Greater Accra regions of Ghana. The findings reveal that consumers have positive perceptions on the health and nutritional benefits of the product. Buyers place a higher value on potagurt relative to normal yogurt. The high value attached to potagurt is mainly linked to the health, nutritional, food safety, and quality attributes of the product, as well as perception. Consumers' socioeconomic factors such as income, educational, and awareness levels also play a significant role in explaining their choice of the product. The practical implication is that the development and promotion of potagurt could stimulate sustainable economic development through better consumer health and improvement in the livelihoods of many players in the sweet potato value chain, especially the producers of potagurt and sweet potato farmers. We conclude that the promotion of the innovative food product could contribute to sustainable production and consumption of sweet potatoes.

Keywords: consumer willingness to pay; new product development; hedonic pricing

1. Introduction

The innovation and knowledge creation and their diffusion are important drivers of global economic growth and development [1]. Paradigm shifts in agrifood systems are stimulating actors and stakeholders in food systems to focus on product development and improvement to meet the ever-changing needs of consumers. The marketing of agrifood products has evolved over time. In the past, there was less emphasis on satisfying consumers' needs. Most agribusiness entrepreneurs focused on bringing their products and services to market with a presumption that consumers would purchase the product once it was available [1]. However, in recent times, such misconceptions are changing. Agribusiness and food enterprises regard consumer needs as the central piece of the sustainability of their businesses. Therefore, they pay critical attention to maintaining a long-term relationship with consumers by satisfying their needs. Consumers are now concerned with their eating habits, notably the type of food product, its nutritional content, and how the product is produced [2]. Ever-increasing populations, rising consumer household incomes, and changing

lifestyles of consumers [2,3], coupled with health issues including malnutrition, trigger the changes in consumer demands for innovative food products.

For instance, the issues of malnutrition and food and nutritional insecurity pose a serious threat to the economic growth and development of developing countries, particularly in Africa [4]. Available estimates show that Africa is one of the continents associated with a high prevalence of malnutrition, food insecurity, and poverty [5]. Existing projections indicate that approximately 759 million people in the world are suffering from undernourishment and the majority (20%) of malnourished people are found in Africa [5]. The growing population in Africa tends to worsen the issues of malnutrition and food insecurity. The current population of Africa is 1.2 billion people, which constitutes 17.17% of the current world population [6]. Africa's population is estimated to double by the year 2030, which suggests there will be a higher demand for nutritious food products. In view of this, some food security interventions are being proposed and implemented in Africa. One of such interventions is the development of innovative and sustainable food products and systems. This has been a priority of most developmental organizations interested in improving value addition capacities of small/medium agrifood enterprises in Africa and other emerging economies. Innovative food products are required to minimize food and nutritional insecurity in Africa, particularly by improving nutrition and health of vulnerable groups such as children and women.

Sweet potatoes have been targeted by the international and local organizations, including the Root and Tuber Improvement Marketing Program (RTIMP) in Ghana, as a strategic crop to promote food security, reduce malnutrition, and enhance livelihoods of rural people in Ghana. Sustainable production and marketing of sweet potatoes by farmers have become a challenge in Ghana due to the lack of value addition and product development. To sustain sweet potato production and marketing, the RTIMP has tried to add value to raw sweet potatoes by processing them into a finished form called potagurt [7]. Potagurt is a blend of milk and sweet potato, which is pasteurized and turned into a nutritious and filling type of yogurt. The RTIMP provided technical assistance such as training on food safety, financial advice and assistance, and enterprise management to the participants of the initiative which were mostly women. Loans and grants in the form of yogurt-making equipment were offered to the women. This innovative food product contains essential nutrients such as beta-carotene (a pro-vitamin-A carotenoid), vitamins B5 & B6, manganese, and potassium which are required for a healthy body. These nutrients are found in sweet potato but are rare in most root and tuber crops. It has been observed that potagurt has been introduced and is highly patronized in northern Ghana [7]. However, this innovative product is yet to be introduced and promoted in the southern part of Ghana. Therefore, there is a limited knowledge about the market potential of the product in southern Ghana.

Our study seeks to address the following research questions:

- i. What are consumer attitudes toward the attributes of potagurt in Ghana? What are consumer perceptions on potagurt in southern Ghana?
- ii. Are consumers willing to pay a premium for potagurt in southern Ghana?
- iii. What factors influence consumer willingness to pay (WTP) a premium for potagurt in southern Ghana?

The aim of the study is to rigorously analyze consumer perceptions and WTP for potagurt and examine determinants of consumers' WTP a premium for the innovative food product.

Sufficient empirical studies exist on consumers' willingness to pay for innovative and new dairy products in developed and developing countries. In developed countries, Vecchio et al. [8] evaluated willingness to pay for omega-3-enriched water buffalo mozzarella cheese in Southern Italy. This study revealed that disease prevention outcome expectations of consumers stimulated their interest to consume the innovative dairy food product. Daria and Alan [9] observed that in the United States of America, consumer willingness to pay for recombinant bovine somatotropin (rBST)-free milk was negatively influenced by the product characteristics such as price and flavor whereas consumer socioeconomic characteristics including, age, education, and income—tended to increase the willingness

to pay estimates. Berges and Casellas [10] found that education and knowledge of product qualities enhanced willingness to pay for milk attributes whereas household size and product price decreased consumer willingness to pay estimates. In China, Bimbo et al. [11] concluded from a systematic review that acceptance for functional dairy products increases with higher diet/health knowledge and aging. Sai-wei et al. [12] showed that Chinese consumers lacked confidence in domestically-produced infant formulas; therefore, most consumers highly preferred quality certified products followed by organic raw milk and farm-to-table traceable products. Yin et al. [13] revealed that certification-inclined consumers had a higher willingness to pay for organic labels whereas origin-preferred consumers displayed higher willingness to pay for infant milk-based formula produced in the United States and New Zealand, and concerned consumers expressed higher willingness to pay for all food safety information attributes. Xu et al. [14] categorized consumers into four segments based on their preferences for imported milk attributes, namely nutrition claim seekers, indifferent, flavored-oriented and price sensitive. They found that nutrition claim seekers were more willing to pay higher price for imported milk with nutrition claims but the indifferent consumers tended to pay little attention to imported milk attributes. Flavor-oriented consumers were associated with a strong preference for strawberry-flavored imported milk whereas price sensitive consumers critically evaluate the price before purchasing imported milk.

In Africa, Wayua et al. [15] concluded from a study in Kenya that even poor consumers were willing to pay for enhanced sensory milk characteristics and assurances if these could be communicated in a trusted manner. In Ghana, Sanful [16] indicated that consumers' acceptance of yogurt fortified with coconut was determined mainly by the product attributes related to appearance, sourness, consistency, aroma, and mouthfeel. From these studies, we observe that empirical studies are yet to evaluate the perceptions and willingness of consumers to pay for potagurt in Ghana. Therefore, there is little empirical knowledge on how the development and promotion of this innovative product in southern Ghana will fare.

Our paper narrows the knowledge gap by contributing to knowledge about nutritional and food security as well as sustainable and innovative food product development in developing economies in several ways. First, this is one of the empirical studies that incorporated consumers' perceptions relating to health and nutritional and mineral content of new food products in Africa. Second, we integrated the contingent valuation and hedonic pricing model in such a manner that they offer theoretical and empirical advantages in terms of measurement and endogenous biases. In this integrated framework, the health, nutritional, and mineral perceptions of the product were not incorporated into the utility functions directly. Instead, factor analysis of these perception variables was first performed and then the resulting constructs were included in the utility function to avoid measurement and endogeneity biases.

Moreover, we contribute to how the promotion of innovative food products like potagurt in Ghana could be replicated in other developing countries to deal with issues of malnutrition, hunger, and food and nutritional security. As mentioned earlier, potagurt is rich in essential micronutrients, which are prerequisites for addressing the malnutrition problem in developing countries. Also, the development of this innovative food product can create a niche market that can be explored by vulnerable groups in the agrifood sector. This new agrifood product market will stimulate the demand for raw sweet potatoes. Accordingly, sweet potato producers will respond to the high demand by increasing their supply of raw sweet potatoes. In the long run, the health of consumers and livelihoods of potagurt producers and sweet potato farmers will be improved. It will also generate job opportunities for many people, particularly women, in the potato value chain in Ghana. These will have a positive trickle-down effect on economic development in Africa in general, and Ghana in particular. Compared with other studies, this paper considered three different regions and findings from this study are more robust and efficient.

2. Materials and Methods

2.1. Conceptual Framework

The concept of new product development is an oriented research aimed at creating products and processes that meet known or anticipated needs of consumers [1]. It also involves a combination and application of knowledge from different scientific disciplines, notably natural sciences, social sciences, food science, and consumer science to design a new product [17]. Theoretical foundation of the present study is based on the normative models of Booz and Hamilton [18] and Cooper and Kleinschmidt [19]. The normative models suggest four main basic stages. The stages are product strategy development, product design and development, product commercialization, and product launch and post-launch. Each stage involves actions that yield results for managerial decision making. Based on a firm's experience and knowledge, some of the activities can be truncated [1]. In this study, the focus was geared towards the product design and development stage. The product design and development stage involved in-house testing and consumer testing, as well as scaling up the product towards commercialization and launching [1]. The process was iterative, and, based on the outcome from the testing, a decision was made whether to proceed to the next stage of commercialization. If the outcome was not satisfactory, the product was redesigned based on the outcome and the stage was repeated until a satisfactory outcome was reached. The iterative process from product design/development stage to launching of the product is illustrated in Figure 1.

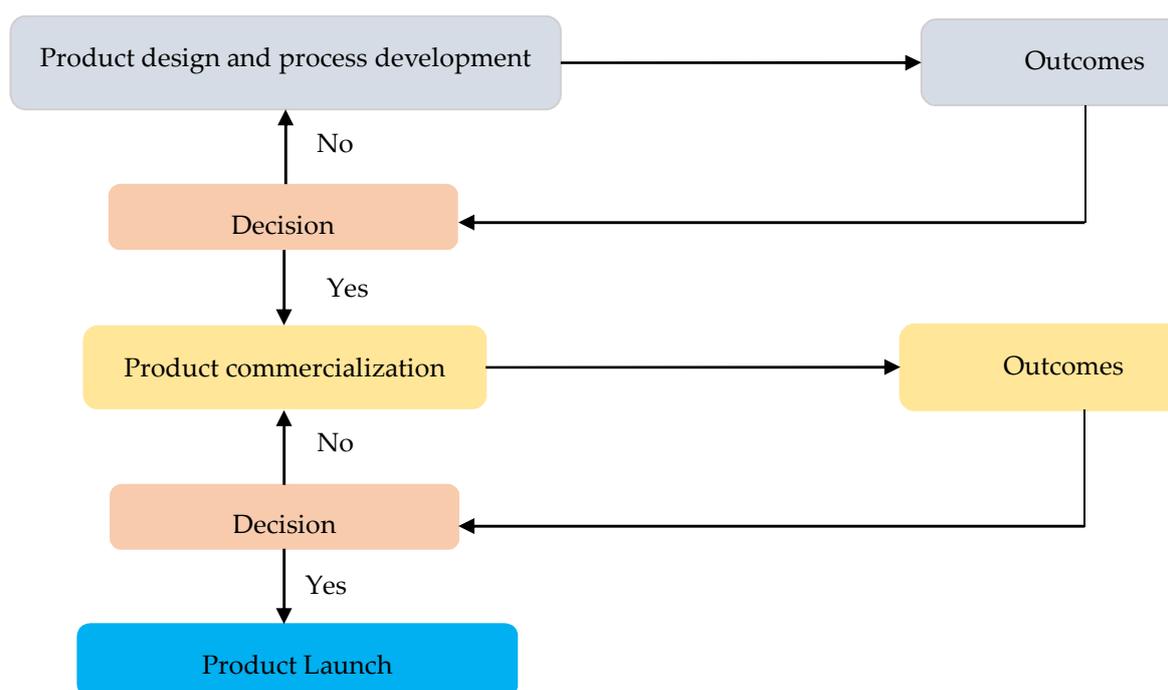


Figure 1. Conceptual framework for the new product development adapted from Earle and Earle [17].

2.2. Empirical Strategy

Prior to the launching of potagurt in commercial quantities in Southern Ghana, it was important to gain better knowledge and insight into how buyers perceive and value the product. This knowledge enabled the producers to redesign the product to satisfy consumer needs and wants. It was vital to know the value buyers attached to the product as defined by its attributes. The maximum monetary value attached to a product by buyers to cater for the rise in utility is termed willingness to pay [20]. This change in utility is evoked by an alteration in some attributes of the product. We positioned our study on consumer theory, which concerns how a rational consumer would make consumption

decisions [21]. In the present study, two main approaches, namely the contingent evaluation method and hedonic modeling approach were applied in the empirical analysis.

2.2.1. Contingent Valuation (CV) Method

We applied the CV method to generate consumers' willingness to pay for potagurt. Given that consumers' responses are assumed to be random variables, we included a stochastic component in our empirical model. Willingness to pay (WTP) distribution was linked to probability of respondents' answers subject to the random utility theory [18]. We denoted the aggregated distribution function of a respondent who is ready to pay as C_d , and his/her matching likelihood density function as c_d , contingent on the nature of questions posed [22]. The nature of question asked in this study was close-ended. Survey participants were asked if they will offer certain amount of money, B for the new product. The possibility that the amount that the participant is willing to offer is $\geq B$ is expressed as:

$$\Pr(WTP \geq B) = 1 - C_d(A) \quad (1)$$

If open-ended questions were posed, then a linear regression on some explanatory variables (Z_i) and a disturbance term (ε) is specified:

$$WTP = \mu_{WTP} + \varepsilon = Z\gamma + \varepsilon \quad (2)$$

This equation incorporates the unsystematic term directly into the utility function, commonly known as random utility models (RUMs) [23]. Given that the preferences of individuals were unobservable, we regarded them as a random variable. In line with the closed-ended single bounded CV nature of questions, we express the likelihood of a participant who responds *yes* to a WTP question as:

$$\Pr(yes) = \Pr(WTP(q^0, q^1, p, y; \varepsilon) \geq A) \equiv 1 - C_d(A) \quad (3)$$

where q^0 and q^1 are scalars for the product valued at the initial (0) and final (1) situations, respectively. p is a vector of product's market prices, y is the buyer's income, and A is the stated amount quoted in the survey instrument. The probability function is expressed as:

$$\Pr(yes) = 1 - C\left(\frac{A - \mu_{WTP}}{\sigma_{WTP}}\right) \equiv 1 - C(-\gamma + \delta A) \equiv H(A) \quad (4)$$

where $\gamma = \mu_{WTP}/\sigma_{WTP}$, $\sigma = 1/\sigma_{WTP}$, μ_{WTP} denotes the expected mean, σ_{WTP}^2 represent the expected variance, and $C(\cdot)$ be the cumulative distribution function.

Hanemann [24] and Carson [25] proposed the double bounded model, which entails probing for a second bid (follow-up question) to the consumer. If the consumer i responded "yes" to the first proposed price, b_{1i} , then a second higher price b_{2i} was presented. If the response to the first bid b_{1i} was "no", then a second lower b_{2i} was presented. The consumer replied *yes* to the first price offered if the utility (W_{1i}) was higher than or equal to the bidding price and *yes* to the second bid if the utility (W_{2i}) was higher than the first bid. This implies that the double bounded specification alludes that random utility model produces both answers to both offers (first and second). The observed outcomes for each consumer can be expressed as follows, where the potential outcomes can be defined as $Y_i = \{0, 1\} = \{no, yes\}$ result to $Y_i = \{Y_{i1}, Y_{i2}\}$

$$\begin{aligned} Y_i = \{1, 1\} &= \{yes, yes\} \Leftrightarrow w_i \geq b_{i2} \\ Y_i = \{1, 0\} &= \{yes, no\} \Leftrightarrow b_{i1} \leq w_i < b_{i2} \\ Y_i = \{0, 1\} &= \{no, yes\} \Leftrightarrow b_{i1} > w_i \geq b_{i2} \\ Y_i = \{0, 0\} &= \{no, no\} \Leftrightarrow w_i < b_{i2} \end{aligned} \quad (5)$$

Based on previous studies, we postulated that consumers’ willingness to pay for potagurt was influenced by their socioeconomic characteristics, product attributes, and consumer perceptions towards the product. The dependent variable (WTP) was censored because some of the consumers were likely to respond “no-no”, a zero response. Hence, a censored Tobit model is employed which is specified as:

$$Potagurt_i = \alpha_0 + \alpha_1 Age_i + \alpha_2 Gender_i + \alpha_3 Hdsiz_i + \alpha_4 Marital_i + \alpha_5 M_inc_i + \alpha_6 Prim_i + \alpha_7 Jss_i + \alpha_8 Sss_i + \alpha_9 Train_i + \alpha_{10} Univ_i + \alpha_{11} Minera_per_i + \alpha_{12} Hea_per_i + \alpha_{13} Nutri_per_i + \alpha_{14} Suga_per_i + \epsilon_i \tag{6}$$

where *Potagurt* denotes a premium price a buyer is ready to offer for potagurt (Gh¢). The description and measurements of explanatory variables are presented in Table 1. ϵ_i denotes the error term. α_0 is the constant term and $\alpha_1, \dots, \alpha_{14}$ denote the coefficients of the explanatory variables. The mineral perception (*Minera_per*), health perception (*Hea_per*), nutritional perception (*Nutri_per*), and sugar content perception (*Suga_per*) were not incorporated into the model directly. These variables were generated from a factor analysis of several items defining these perception variables. This was done to avoid measurement and endogeneity biases.

Table 1. Description of variables and summary characteristics.

Variable	Description	WTP Sample Mean (SD)	UNWTP Sample Mean (SD)	Mean Difference
<i>Socioeconomic characteristics</i>				
Age	Years	32.26 (1.90)	33.26 (2.11)	1.00
Household size	Number of people in the house	4.09 (0.99)	4.65 (1.01)	−0.56
Income	Monthly income of respondents Gh¢	465.91 (21.00)	410.76 (12.00)	55.15 *
Marital status	1 if married, 0 otherwise	0.40 (0.12)	0.39 (0.12)	0.01
Female	1 if female, 0 otherwise	0.68 (0.06)	0.45 (0.08)	0.23 **
Prim	1 if primary school was the highest educational level, 0 otherwise	0.12 (0.09)	0.25 (0.10)	−0.13 **
JSS	1 if junior high school was the highest educational level, 0 otherwise	0.24 (0.10)	0.23 (0.21)	0.01
SSS	1 if senior high school was the highest educational level, 0 otherwise	0.13 (0.02)	0.17 (0.10)	−0.04
Train	1 if training college was the highest educational level, 0 otherwise	0.25 (0.04)	0.17 (0.11)	0.08 *
Univ	1 if university was the highest educational level, 0 otherwise	0.26 (0.07)	0.18 (0.09)	0.08 *
<i>Perception and knowledge variables</i>				
Minera_per	Mineral content of potagurt (1 = bad; 2 = fair; 3 = good)	2.53 (0.14)	2.18 (0.11)	0.35 **
Hea_per	Health benefits of potagurt (1 = bad; 2 = fair; 3 = good)	2.94 (0.31)	2.05 (0.23)	0.89 ***
Nutri_per	Nutritional benefits of potagurt (1 = bad; 2 = fair; 3 = good)	2.89 (0.21)	1.98 (0.14)	0.91 ***
Suga_per	Low sugar content of potagurt (1 = bad; 2 = fair; 3 = good)	2.99 (0.99)	1.99 (1.08)	1.00 **

*, ** and *** denotes significance at 10%, 5% and 1% level respectively. WTP = willingness to pay, UNWTP = unwillingness to pay.

2.2.2. The Hedonic Modeling Approach

To attain the monetary values attached to the specific attributes, we employed the hedonic model. This modeling approach posits that consumer purchasing decision is based on the product attributes [26]. Assuming that potagurt consists of *k* attributes X_1, \dots, X_n , the price of the potagurt is contingent on the number of attributes that the product possesses [27]. The price is stated as a function of the attributes $P(X)$. Consumer WTP for X_i is then stated as a function $F_i(\cdot)$ of the number of attributes of potagurt and Z_i denotes the explanatory variables. Assuming that $P_i(X)$ is inferred as the

implied market value for the attribute X_i , the symmetry postulation leads to the specification of the structural model:

$$P_i(X) = F_i(X_1, \dots, X_n, Z_i), i = 1, \dots, N \quad (7)$$

where $\partial P_i(X)/\partial X_i = P_i(\hat{X})$ denotes the implied marginal prices and market equilibrium price function $P_i(X)$ implied in $P(X)$. The hedonic model is estimated in two stages. In the first stage, $P(X)$ is estimated without the inclusion of Z_i , only P_i is regressed on all the attributes using the optimal functional form [28]. The weakness of this estimation approach is that there is a duplication of price determinants [28]. Hence, in the second stage estimation, we computed implied marginal prices, $P_i(\hat{X}) = \partial P_i(X)/\partial X_i$, for each respondent. The predicted marginal implied prices $P_i(\hat{X})$ are used as the explanatory variables in Equation (7). We used the linear Box–Cox transformation [28,29] to get a non-linear function for price and the different product attributes. This is expressed as:

$$P_x^\lambda = \alpha + \beta X_i + \phi Z_i + \xi_i \quad (8)$$

where P_x^λ is the price of potagurt; α is constant term, X_i represents a vector of potagurt attributes and β is a vector of its associated coefficients, Z_{ip} are exogenous variables, ϕ is the equivalent vector of coefficients, and ξ_i is disturbance term. The Box–Cox transformation P_x^λ is specified as:

$$P_x^\lambda = (P_x^\lambda - 1)/\lambda, \lambda \neq 0; P_x^\lambda = \ln P, \lambda = 0 \quad (9)$$

Several lambda (λ) values are calculated and the best value that maximizes the log-likelihood function is chosen. A lambda value of one favors a linear equation, while zero favors the natural logarithm or a semi-log functional form of the endogenous variable [30]. In our analysis, we found lambda value of 0.3 to be appropriate. Hence, we adopted the semi-log functional form and express our hedonic model as:

$$\ln P_{xi} = \gamma_0 + \sum_{k=1} \gamma_k \text{PotAtrib}_{ki} + \sum_{j=1} \gamma_j Z_{ji} + \mu_i \quad (10)$$

where $\ln P_{xi}$ is the natural logarithm of the value offered by the respondent i for potagurt; PotAtrib_{ki} is a set of product attributes including, mineral content, healthiness, nutritional content, low sugar level of potagurt; Z_{ij} and μ_i is the error term.

2.3. Data Description

The target population consisted of consumers of yogurt in southern Ghana, namely Ashanti, Greater Accra, and Eastern regions. The capital cities of these regions were selected purposely because consumers of dairy products are mostly the middle and high-income consumers. The sample size for the study was 400, comprising 200 consumers from Greater Accra in the Greater Accra region, 149 from Kumasi in the Ashanti region, and 51 from Koforidua in the East region. A multistage stratified sampling technique was employed. A structured questionnaire was designed to collect the primary data from the sampled consumers. The questionnaire was categorized into two sections. The first section solicited information on the consumers' socioeconomic characteristics. The second section captured information on the consumers' WTP and perceptions of potagurt, as well as the attributes that consumers consider when purchasing potagurt.

Table 1 presents the descriptive statistics of variables. The mean age for consumers who were willing to pay for potagurt was 32 years old while that of those who were not willing to pay was 33 years. The mean age difference between the willingness to pay (WTP) and unwillingness to pay (UNWTP) was 1 year which is not even statistically significant at the 10% level. The mean difference for gender was also not statistically significant. However, more males (42%) expressed UNWTP for potagurt. Consumers who expressed WTP had a mean household size of 4 persons whereas those who showed UNWTP had a mean household size of 5 people. The mean household size for those who expressed WTP was less than those who showed UNWTP. The mean difference between mean

household size of WTP and UNWTP respondents was 0.56, which is statistically significant at the 10% level. Large households are associated with a higher expenditure on food, which limits their purchasing power.

The mean monthly income for consumers who were willing to pay was Gh¢466.91 (\$121.863 US). This is greater than the mean monthly income of those who were unwilling to pay for potagurt (Gh¢410.76 (\$107.208 US)) (Table 1). This evidence implied that consumers with higher monthly incomes are more willing to pay for potagurt than those with lower monthly incomes. However, the mean difference was not statistically significant. The mean difference of marital status between WTP and UNWTP consumers was not also statistically significant. In terms of educational level, the majority of the consumers who had training education were more willing to pay for potagurt compared to those who were unwilling to pay (see Table 1). The mean difference was statistically significant at the 1% level. However, regarding primary, secondary, and university education, there were no significant differences between WTP and UNWTP consumers.

We also found that consumers who were willing to pay for potagurt tended to have a significant higher positive perception about the mineral content of potagurt, compared with those who were not willing to pay. The findings that were similar to the perceptions of WTP and UNWTP consumers on the health benefits of potagurt. The mean difference was statistically significant at the 1% level. Similarly, the mean difference between the nutritional benefit perception index of WTP and UNWTP consumers was statistically significant at the 1% level. The mean difference between WTP and UNWTP regarding the perception that potagurt had low sugar content among consumers was statistically significant at the 1% level.

3. Empirical Results

3.1. Consumers Attitudes towards the Attributes of Potagurt

The consumers were asked to rate the attributes of potagurt. Five rating scales were used: not important (1), somewhat important (2), neutral (3), important (4), and very important (5). The summary of the responses regarding the consumers' ratings of the attributes of potagurt is presented in Table 2.

Table 2. Consumers' importance ratings of potagurt attributes.

Attribute	Pooled	Ashanti	Eastern	Greater Accra
Price	4.31	3.91	4.63	4.53
Low sugar level	4.38	4.36	4.10	4.47
Health benefits	4.60	4.79	4.67	4.44
Nutritional benefits	4.53	4.75	4.59	4.35
Taste	4.37	4.43	4.47	4.29
Less fat	4.25	4.31	3.96	4.28
Flavor	3.89	3.77	3.08	4.18
Safety of potagurt	4.25	4.32	4.65	4.10
Vitamin content of potagurt	4.21	4.52	3.86	4.06
Mineral content of potagurt	4.19	4.49	3.80	4.06
Food and Drugs Board (FDB) approval/certification	4.16	4.51	4.86	3.72
Appearance	3.99	4.27	4.53	3.68
Fiber content	3.85	4.13	3.71	3.68
Labeling	3.87	4.05	4.43	3.58
Color	3.12	2.54	3.08	3.57

Source: Authors' computation (2020).

The sampled consumers deemed certain attributes of potagurt to be more important than others. The pooled data suggest that consumers rated health benefits, nutritional benefits, low sugar level, taste, and price as the top five most important attributes. However, in the Ashanti region, consumers ranked health benefits, nutritional benefits, vitamin content, Food and Drugs Board (FDB) approval

(certification), and mineral content of potagurt as the top five most important attributes. In the Eastern region, consumers rated FDB approval (certification), health benefits, safety, price, and nutritional benefits as the top five most important attributes.

The results further showed that consumers in the Ashanti region considered the health and nutritional benefits of potagurt more than consumers in the Eastern and Greater Accra regions. Consumers in the Eastern region were more particular about the price of potagurt compared to those in the Ashanti and Greater Accra regions. This implies that any investor who wants to sell potagurt in the Eastern region of Ghana should consider other pricing strategies to be competitive and successful.

3.2. Consumers' Perceptions of Potagurt

Consumers were asked to give their perception about some statements. A 5 Likert scale was used—strongly agree (1), agree (0.5), neutral (0), disagree (−0.5), and strongly disagree (−1). A perception index was computed to understand the overview of consumers' perceptions regarding the attributes of potagurt. The attributes were categorized into three main perception statements: health, nutritional, and purchasing. Consumers' responses with respect to the various perception statements are reported in Table 3. The majority (72.3%) of the consumers indicated that they agree with the perception that potagurt is rich in phytochemicals that reduce diseases and benefit human health. Moreover, 18.8% strongly agreed with this same perception statement but 1.3% disagreed. We found that 90.1% of the consumers interviewed agreed that potagurt's fiber, potassium, vitamin A, and vitamin B-6 coupled with its lack of cholesterol, which all support heart health. The positive perception of this statement could be because the orange-fleshed sweet potatoes used in the preparation of potagurt contain high levels of vitamin A, vitamin B-6, and potassium, and has high fiber content. However, 0.8% of the consumers disagreed to this statement. Out of the 400 consumers interviewed, 91.8% agreed that the vitamin A in potagurt reduces the risk of night blindness. The positive perception of this statement is because consumers were aware that vitamin A deficiency leads to night blindness or poor eyesight. Consumers, therefore, preferred to consume food that contains high levels of vitamin A. Only 1% of the consumers disagreed that potagurt reduces the risk of night blindness. Most consumers (92.3%) perceived that potagurt is healthy. Consumers' positive perception towards this statement stems from their believe that normal yogurt supplies the body with protein and other essential nutrients but potagurt provides extra essential micro-nutrients such as vitamin A, which is an important nutrient needed by the body. The mean health perception index is 0.57 suggesting that the consumers had positive perceptions regarding the healthiness of potagurt. On nutritional perceptions of consumers on potagurt, majority (81.3%) of them agreed that potagurt has a better taste and nice flavor than normal yogurt (Table 3).

The nice flavor of potagurt actually comes from the addition of baked potatoes. However, 7.8% disagreed to this statement. Out of the 400 consumers, 92.1% agreed that potagurt has a lower level of sugar than the normal yogurt. The use of sweet potatoes in preparing potagurt acts as a natural sugar or sweetener. The natural sugar in sweet potato is not harmful to the body compared to the synthetic sugar used mostly in yogurt production. Consumers are becoming conscious of their health due to the negative effects of sugar consumption to the body. Synthetic sugar consumption puts stress on the liver, increases cholesterol, and causes weight gain.

Table 3. Consumers' perceptions of potagurt.

<i>Health Statement</i>	Strongly Agree (1)	Agree (0.5)	Neutral (0)	Disagree (−0.5)	Strongly Disagree (−1)	Mean Scores
Potagurt is rich in phytochemicals that ward off disease and benefit human health.	75 (18.8)	289 (72.3)	31 (7.8)	5 (1.3)	0	0.54
Potagurt is rich in minerals needed by the body to fight against diseases	94 (23.5)	264 (66.0)	40 (10.0)	2 (0.5)	0	0.56
The potato's fiber, potassium, vitamin C, and vitamin B-6 content in potagurt, with no cholesterol, all support heart health	81 (20.3)	279 (69.8)	37 (9.3)	3 (0.8)	0	0.55
The vitamin A in potagurt reduces the risk of night blindness	103 (25.8)	264 (66.0)	29 (7.3)	4 (1.0)	0	0.58
Potagurt is healthy	137 (34.3)	232 (58.0)	29 (7.3)	2 (0.5)	0	0.63
HEALTH PERCEPTION INDEX						0.57
<i>Nutritional statements</i>						
Potagurt is more nutritious than the normal yogurt	192 (48.0)	145 (36.3)	42 (10.5)	14 (3.5)	7 (1.8)	0.63
Potagurt has better taste and nice flavor than normal yogurt	169 (42.3)	156 (39.0)	44 (11.0)	26 (6.5)	5 (1.3)	0.59
Potagurt is used in the formulation of 'Herbal Life Products'	41 (10.3)	119 (29.8)	210 (52.5)	27 (6.8)	3 (0.8)	0.21
Potagurt is enriched with vitamin A	85 (21.3)	258 (64.5)	53 (13.3)	4 (1.0)	0	0.53
Potagurt is rich in dietary fiber due to the fortification of potatoes	75 (18.8)	277 (69.3)	47 (11.8)	1 (0.3)	0	0.53
The sugar level of potagurt is lower than normal yogurt	267 (66.8)	101 (25.3)	18 (4.5)	5 (1.3)	9 (2.3)	0.78
Because of the potatoes fiber content in potagurt, it helps to prevent constipation and promote regularity for a healthy digestive tract.	86 (21.5)	246 (61.5)	62 (15.5)	4 (1.0)	2 (0.5)	0.51
NUTRITIONAL PERCEPTION INDEX (NPI)						0.54
<i>Purchasing statements</i>						
I am willing to pay somewhat more for a potagurt due to its health benefits	113 (28.3)	186 (46.5)	68 (17.0)	26 (6.5)	7 (1.8)	0.47
I am willing to pay somewhat more for a potagurt due to its nutritional benefits	91 (22.8)	208 (52.0)	71 (17.8)	23 (5.8)	7 (1.8)	0.44
I would buy potagurt if it sells at the same price as the normal yogurt but was much more nutritious	141 (35.3)	217 (54.3)	32 (8.0)	9 (2.3)	1 (0.3)	0.61
I would be willing to buy potagurt if they were more available	100 (25.0)	233 (58.3)	57 (14.3)	9 (2.3)	1 (0.3)	0.53
I have no problem with buying potagurt	82 (20.5)	245 (61.3)	62 (15.5)	9 (2.3)	2 (0.5)	0.50
I would be willing to buy potagurt if they are labeled or branded	128 (32.0)	236 (59.0)	32 (8.0)	3 (0.8)	1 (0.3)	0.61
I would be willing to buy potagurt if the health claims are displayed on the product	137 (34.3)	216 (54.0)	32 (8.0)	12 (3.0)	3 (0.8)	0.59
PURCHASING PERCEPTION INDEX (PPI)						0.54
OVERALL MEAN PERCEPTION INDEX						0.55

Values in parenthesis are percentages. Source: Authors' computation (2020).

We further found that 3.6% of consumers disagreed that potagurt has a lower sugar level. Also, 5.3% disagreed that potagurt is more highly nutritious than normal yogurt but 84.3% agreed to this statement. The mean perception index for the nutritional perception statements was 0.54, which implies that consumers have a positive perception towards the nutritional benefits of potagurt.

Turning our attention to the purchasing perceptions of consumers, about 46.5% of the respondents indicated that they are willing to pay somewhat more for potagurt due to its health and 52% willing to pay somewhat for potagurt due to its nutritional benefits. People are now concerned about their health which motivates them to pay extra for healthy and nutritious foods. However, 8.3% disagreed with paying somewhat more for potagurt due to its health and 7.6% disagreed to pay somewhat for potagurt due to its nutritional benefits. Out of the 400 sampled consumers, 83.3% were willing to buy for potagurt if the product was more available and 81.8% had no problem buying potagurt. This evidence suggested that most consumers are willing to buy potagurt if it was more available since they have no problem buying it. Only 2.6% of the consumers disagreed with buying potagurt if it was more available and 2.8% had a problem buying potagurt. We observed that 91% of consumers were willing to buy labeled or branded potagurt, and 88.3% were willing to buy potagurt if health claims were displayed on the product. These findings suggest that consumers are now very conscious of what they consume and especially, would want to know the health benefits, ingredients used, and other vital labeled information. The mean perception index of 0.54 for consumer purchasing behavior shows that generally consumers had a positive perception towards purchasing of potagurt. The overall mean perception index of 0.55 is positive indicating that consumers would like to purchase potagurt more than the normal yogurt.

3.3. Determinants of WTP Premium for Potagurt

The chi-square value (50.91) was statistically significant at the 1% level indicating the explanatory variables included in the model jointly explain the variation in buyers' willingness to pay a premium for potagurt (Table 4). Among the factors included in the Tobit model, monthly income (*M_inc*), training graduates (*Train*), university graduates (*Univ*), perception about the mineral content of potagurt (*Minera_per*), perception about the healthiness of potagurt (*Hea_per*), perception about the nutritional content of potagurt (*Nutri_per*), and perception about sugar level of potagurt (*Suga_per*) had significant positive effects on consumers' WTP a premium for potagurt.

Table 4. Determinants of consumers' WTP a premium for potagurt.

Variable	Coefficient	t-Value	Probability
Age	−0.0079	−0.75	0.455
Gender	0.1351	0.68	0.495
Household size	−0.0223	−0.50	0.619
Marital status	0.1056	0.44	0.658
Income	0.6891 *	1.82	0.055
Jss	0.2788	1.05	0.295
Prim	0.2047	0.62	0.537
Train	0.7708 **	2.16	0.031
Univ	0.5201 *	1.92	0.055
Minera_per	0.5821 *	1.65	0.100
Hea_per	0.7458 **	2.57	0.011
Nutri_per	0.7213 **	2.26	0.025
Suga_per	0.8908 ***	3.35	0.001
Constant	0.4499	0.59	0.556
LR 57.56 ***			
Log likelihood −691.39			
Number of observation 400			

***, ** and * denote 1%, 5% and 10% statistical significance. Source: Authors' computations (2020).

The coefficient of the training variable was positive and statistically significant at the 5% level. This finding indicates that consumers' training background on teaching or nursing or polytechnic education are more willing to pay a GhC0.771 (\$0.201 US) premium for potagurt compared to those with senior high school educations. The positive and significant coefficient of 0.5201 for the university education variable implies that consumers with university education are more willing to pay GhC0.520 (\$0.135 US) for potagurt compared to those with senior high school (SHS) education.

The positive and significant coefficient of 0.5821 for the perception variable about potagurt being rich in minerals that are needed by the body to fight against diseases due to the addition of sweet potatoes suggests that consumers with a positive perception about this statement are more likely to pay a GhC0.581 (\$0.151 US) premium for potagurt compared to their counterparts.

The perception that potagurt has more health benefits than normal yogurt was significant at 5%. This result suggests that if consumers have a positive perception about the health benefits of the product, their willingness to pay for potagurt will increase by GhC0.746 (\$0.194 US). This finding is consistent with that of Wayua et al. [15] and Bimbo et al. [11]. Perception about potagurt having a lower sugar level than the normal yogurt was significant at the 10% level. This result showed that if consumers have a positive perception about this statement, their willingness to pay for potagurt tends to rise by GhC0.891 (\$0.234 US). Positive perception of the nutritional benefits of potagurt increased consumers' willingness to pay significantly.

3.4. WTP Premium for Potagurt

We found that more respondents were willing to offer a higher premium for potagurt relative to the normal yogurt (Table 5). The price of 500 mL for normal yogurt was GhC2.5 (\$0.78 US). Respondents with the *yes–yes* responses were ready to offer GhC4 (\$1.04 US) for 500 mL of potagurt. The empirical results showed that 22.50% of the consumers were WTP GhC4 for potagurt. Consumers with the *yes–no* response were willing to pay GhC3.50 (\$0.91 US) for 500 mL of potagurt. We found that the majority (54.50%) of the consumers were willing to offer GhC3.50 (\$0.91 US). Consumers with a zero willingness to pay observation (*no–no* responses) were those who expressed an unwillingness to pay a premium and this segment consisted of 23% of the pooled sample.

Table 5. Marginal implicit prices for product attributes from hedonic model.

Product Attributes	Marginal Implicit Price (Ghc)			
	Ashanti	Eastern	Greater Accra	Pooled
Taste	0.75	0.71	0.90	1.01
Flavor	0.87	0.31	0.78	0.86
Color	0.33	0.35	0.97	0.89
Safety (FDB approval)	1.11	1.91	1.33	1.59
Packaging	0.55	0.21	0.60	0.41
Low sugar content	1.47	0.95	1.85	1.55
Healthiness	1.73	1.46	1.45	1.75
Mineral content	1.09	0.81	1.04	1.21
Fiber content	0.88	0.57	0.91	0.99
Vitamin content	1.22	1.02	1.22	1.33
Nutritional content	1.53	1.04	1.40	1.56
Mean WTP (500 mL)	3.85	3.25	4.05	4.50

Authors' computations (2020).

The impact of product attributes on the total value that consumers are willing to offer represents the implicit price of the product attribute to the WTP premium of potagurt [28]. The estimation was done for the three surveyed regions to explore the location differences and market potential for the product across the regions. The estimated mean WTP amount for 500 mL of potagurt was GhC3.85 (\$1.00 US), GhC3.25 (\$0.85 US), and GhC4.05 (\$1.06 US) for the Ashanti, Eastern, and Greater Accra

regions, respectively (Table 5). Comparing the mean willingness to pay from the hedonic model to that of the descriptive statistics in Table 5, we could infer that the mean willingness to pay after the attribute evaluation was higher. The mean willingness to pay amount for 500 mL of potagurt for the pooled sample was GhC4.50 (\$1.17 US). In the Ashanti region, we found that the healthiness attribute was valued the highest with an amount of GhC1.73 (\$0.45 US). This was followed by nutritional, low sugar, and vitamin content with amounts of GhC1.53 (\$0.40 US), GhC1.47 (\$0.38 US) and GhC1.22 (\$0.32 US), respectively. The lowest ranked attribute was product color, with an amount of GhC0.33 (\$0.09 US).

In the Eastern region, Food and Drug Board (FDB) approval was the highest valued attribute with an amount of GhC 1.91 (\$0.50 US). This was followed by food safety, healthiness, vitamin content, and low sugar content with WTP estimates of GhC1.46 (\$0.38 US), GhC1.04 (\$0.27 US), GhC1.02 (\$0.27 US), and GhC0.95 (\$0.25 US), respectively (Table 5). In the Greater Accra region, the highest valued attribute was low sugar levels with an amount of GhC1.85 (\$0.48 US). This was followed by healthiness, nutritional content, vitamin content, and food safety with WTP estimates of GhC1.45 (\$0.38 US), GhC1.40 (\$0.37 US), and GhC1.33 (\$0.45 US), respectively.

4. Discussion

The consumers surveyed were generally within the active working age, with the majority of them having attained at least senior high school education, as indicated by the summary statistics for both categories of consumers. Interestingly, we found that most females were willing to pay for the new product. This evidence is consistent with findings by Conner and Oppenheim [31] and Owusu-Sekyere et al. [32] who explained that in most African settings, females are noted for grocery shopping.

Sustainable production and marketing of the product depends on how it is perceived by consumers. In terms of how the product attributes are rated, our results suggest that consumers in the Eastern region are more concerned about food safety issues, relative to the other regions. In the Greater Accra region, consumers are more concerned about price, low sugar level, health benefits, nutritional benefits, and taste. The differences in preference and rating of the attributes of the product reveal the existence of preference heterogeneity. This is supported by the finding of Owusu-Sekyere et al. [32] who found that Ghanaian consumers are heterogeneous in their choice of attributes related to food safety and quality. Moreover, the region-specific preferences justify the need to examine and establish regional-specific preference attitudes among consumers when it comes to new product development. Generally, the findings portray the existence of regional variation in preferences for new product development and this is in line with the work of Owusu et al. [32] who found that there are regional variations in preferences for cassava–wheat composite bread, a new product developed and tested in Ghana. This insight can potentially assist product developers and investors to know which attributes to target for enhancing innovative product development and marketing. For instance, dairy product investors and developers who want to sell in the Eastern region should focus on certifying products to ensure food safety before thinking about health benefits and pricing strategies to be more competitive and successful.

Consumers are ready to offer relatively higher value for potagurt relative to normal yogurt. From the pooled sample, the mean willingness to pay from the marginal implicit estimates indicated that respondents are willing to offer Ghc4 (\$1.04 US). Our study revealed that willingness to pay estimates vary across the three surveyed regions, with Greater Accra offering the highest amount, followed by Ashanti and Eastern regions, respectively. This shows that there are segments of the consumers who are not willing to offer premium for the product. However, the majority of the consumers are willing to pay.

Another finding worth discussing is that demographic targeting of consumers will be a feasible marketing strategy to be adopted for the product marketing and development. Specifically, we found that educational levels were significant factors to be considered when identifying a niche market for this new food product. For instance, the findings on different educational levels and their impact on

willingness to pay for the product suggested that any rational investors who want to invest in the potagurt business should strategically position themselves around training and university campuses and also around areas where the product can be easily reached by highly educated consumers. This observation is consistent with the findings of Piyasiri and Ariyawardana [33] and Owusu and Anifori [34]. Also, considering that income played a significant role in the valuation of the product attributes, it is likely that the product will be accepted in middle–high income class areas.

Besides socioeconomic characteristics, consumers' perceptions about the product played a vital role in understanding their willingness to pay. The display of the product attributes and health benefits through labeling should be considered the main driver of consumers' willingness to pay and for the future development of the product. This evidence corroborates findings from Yin et al. [13] and Xu et al. [14]. Therefore, we recommend that more emphasis should be placed on the attributes of potagurt, particularly regarding the health, nutrition, fat content, and safety of the product since consumers rate these attributes to be very important when purchasing the product.

Furthermore, potagurt must be promoted by increasing awareness among consumers. Students at the tertiary level should be targeted for potagurt sales since tertiary graduates were more willing to offer premiums for the product. High income residential areas should also be targeted since consumers with higher incomes tended to offer a high premium for potagurt. The results generally suggested that food safety, nutritional quality, healthiness, and sugar and vitamin constituents are very important for the development of potagurt, an innovative product that can contribute to sustainable development objectives. Hence, there is a need for increasing advertisement on the nutritional, health, and quality attributes of the product.

Ultimately, insights on the highly rated product attributes and the significant factors that drive consumers' choice can be capitalized on to change consumption and production patterns, particularly for the sweet potato value chain. Over the years, the production and consumption of sweet potatoes have been unsustainable, coupled with high postharvest losses. Ghana has taken imperative measures for the development and value addition to raw sweet potato by processing it into a finished form called potagurt, and so scientific research on its prospective and actual uptake is very relevant to sustainable development goals. This initiative in Ghana can be adopted by other developing countries, particularly in Africa to deal with unsustainable production and consumption of sweet potatoes, malnutrition, hunger, and food insecurity.

5. Conclusions and Policy Implications

The key conclusions deduced from the study are outlined as follows. First, from the perception estimates, we concluded that consumers generally had positive perceptions regarding potagurt in terms of health impacts, nutritional value, and purchasing desire. We also concluded that consumers were more conscious of their health and therefore, more willing to purchase the potagurt, subject to the attributes the product possesses. It is recommended that the following areas should be addressed in the future. Addressing malnutrition, hunger, and food and nutrition insecurity in Ghana requires the development of sustainable production and marketing of innovative products with health and nutritional benefits. Our study did not consider the cost and benefit associated with the production of potagurt. Therefore, we suggest that further research should examine the financial viability of the potagurt industry in Ghana. The study was limited to only three regions due to the time factor. Hence, we recommend that further research should include other regions to understand consumers' behavior towards the product across in all regions in the country. Our study did not account for preference heterogeneity so future research should consider using approaches that account for preference heterogeneity.

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