Consumer preference for novelty in processed foods: a developing country perspective

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Received 14 March 2019
Revised 30 August 2019
Accepted 19 October 2019

Abstract

Purpose – The paper aims to explore consumer preferences for novel and other quality attributes in processed foods. It focuses on preferences for product origin, certification on food quality and standards and tradeoffs between novelty (fortification and highly processed) and other quality attributes.

Design/methodology/approach – In total, 317 consumers were randomly selected at a high-end supermarket and a traditional local market in Dar es Salaam, Tanzania. Stated and revealed preference approaches were used to investigate their preferences for different attributes in processed foods. A hypothetical choice experiment was used to assess consumer preference for six baby food attributes and the tradeoffs between the attributes, while the revealed preference method included questions on consumer's actual processed food purchasing and consumption habits. In addition, consumers were asked a series of hierarchical questions assessing the motivation underpinning their choices for different products attributes.

Findings – When making choices for processed food attributes, consumers are reluctant to choose novel technologies and have a strong preference for natural, nutritious, tasty and quality processed food attributes. However, they are willing to forego their preference for naturalness and to overcome their reluctance to trying novel technologies when the novelty is embedded with such quality benefits as nutrition, but not so when the embedded benefit is convenience. They are also willing to trade off their preference for nutrition for a sensory taste. This suggests that micronutrient deficiencies can be reduced among women and children under five by employing the appropriate strategies in processed food formulation. Further, the preference for product origin highlights the opportunity for national brands to fill the gap created by the increasing demand for processed foods in Tanzania.

Research limitations/implications – The study claims a developing country perspective but is only representing consumers in one city in a developing country. However, this study speculates that consumers with representative characteristics in such context are likely to behave the same. Furthermore, although this study controlled for a hypothetical bias, having a hypothetical choice experiment with non-shoppers (non-purchasers) could have triggered the hypothetical bias, making participants concentrate more on non-price than price attributes.

Originality/value – The paper offers a developing country perspective on consumers' preferences for novelty in processed foods and tradeoffs with other quality attributes.

Keywords Certification, Consumer preference, Developing countries, Fortification, Novelty, Nutrition, Processed food, Product origin

Paper type Research paper

The authors are grateful for the financial support from the Danish International Development Agency (DANIDA) through the BSU II project – Building Stronger Universities phase II. The authors specifically thank the project leaders, Dr. Daniel Mushi, Dr. Anna Temu and Dr. Zena Mpenda, for their cooperation in this work. The authors also thank Dr. Vincenzina Caputo of Michigan State University, USA, and Dr. Frode Alfnes of the Norwegian University of Life Sciences for their help in designing the choice experiment.

Journal of Agribusiness in Developing and Emerging Economies
Vol. 10 No. 4, 2020
pp. 429-446

2044-0839
DOI 10.1108/JADEE-03-2019-0036

1. Introduction

Changes in lifestyles coupled with transformations in food systems have caused increased consumption of processed foods in Tanzania. The associated negative impact of the influx of processed foods of questionable safety and nutritional value is adding to the public health burden of non-communicable diseases. Conversely, the increased consumption of processed foods presents an opportunity for improved nutritional security through fortifying processed foods with micronutrients (Popkin *et al.*, 2012; Monteiro *et al.*, 2013).

Tanzania faces widespread micronutrient deficiencies, causing a loss of around 2.65 percent of the gross domestic product (GDP) (equivalent to US$518m) every year (TNNC, 2014; Bellows *et al.*, 2017). The deficiencies are especially high among women of reproductive age and children under five and are the highest with respect to iron and vitamin A, where 58 percent of women and 45 percent of children are anemic, and 33 and 37 percent of women and children, respectively, are deficient in vitamin A (NBS and ICF Macro, 2011; TNNC, 2014). Nutrition stakeholders in Tanzania have taken advantage of the rapid changes in the food systems to combat the widespread micronutrient deficiencies through the fortification legislation of 2012, which requires all businesses to fortify wheat flour, maize flour and vegetables oils with iron, vitamin A and zinc (TFDA, 2012). Significant progress in the fortification has been achieved in oil and wheat flour, but very little progress in fortifying maize flour. Among the reasons for this poor progress are: the nature of the industry – maize processing is dominated by numerous small-scale and a few medium-scale millers making the control and enforcement of regulation difficult; the initial investment costs are too high for small-scale millers; and widespread perception that the fortificants contain chemicals that suppress reproductive health. If the vulnerable are not willing to purchase foods enriched with micronutrients, it is unlikely that the processing firms will invest in fortified foods, meaning that policy-makers and the other nutrition stakeholders will have failed to take advantage of the changing food systems to combat nutritional insecurity.

This paper presents the results of a survey conducted to investigate consumer preferences for attributes in processed foods including, novelty (fortification and level of processing), product origin, certification on food quality and standards and other quality attributes attached to processed foods (such as food safety, nutrition, sensory taste and naturalness).

To our knowledge, apart from Oparinde *et al.* (2016) and Wanyama *et al.* (2019), who examined the tradeoffs between nutrition and sensory taste, and De Groote *et al.* (2018) between nutrition and naturalness, no study in Sub-Saharan Africa has assessed the tradeoffs between different quality attributes in novel products. This study gives a developing country perspective on consumer preferences and tradeoffs between novelty and other quality attributes of processed foods. The study contributes to the growing literature on choice experiments in Africa (Meenakshi *et al.*, 2012; Probst *et al.*, 2012; Nandonde *et al.*, 2013; Alphonce and Alfnes, 2017) and consumer valuations of novel food products or products produced using unfamiliar technologies (such as fortification, bio-fortification and genetically modified) in Africa (Kimenju and De Groote, 2008; Naico and Lusk, 2010; Chowdhury *et al.*, 2011; De Groote *et al.*, 2011, 2014, 2018; Kikulwe *et al.*, 2011; Demont *et al.*, 2012; Meenakshi *et al.*, 2012; Oparinde *et al.*, 2016; Okello *et al.*, 2018; Wanyama *et al.*, 2019).

2. Studies on consumer preference for novelty and other quality attributes

The body of knowledge on consumer preferences for quality attributes suggests that safety, nutrition and taste are among the most important product attributes for consumers in the Global North (Lusk and Briggeman, 2009; Kraus, 2015; Dolgopolova and Teuber, 2017). Reportedly, food safety is especially important when unfamiliar technologies like genetically modified organism (GMO), fortification, industrial processing and food irradiation are introduced (Grunert and Grunert, 1995). Apart from the top three attributes, consumers from

the Global North also value natural and fresh products over artificial and highly processed foods (Teratanavat and Hooker, 2006; Krystallis *et al.*, 2008; Peterson and Li, 2011; Clark *et al.*, 2019).

Similarly, studies from Africa report that consumers value nutrition, sensory and safety attributes (Masters and Sanogo, 2002; De Groote *et al.*, 2011; Meenakshi *et al.*, 2012; DeGroote *et al.*, 2014; Birol *et al.*, 2015; Oparinde *et al.*, 2016; Dolgopolova and Teuber, 2017; Owusu *et al.*, 2017; De Groote *et al.*, 2018; Okello *et al.*, 2018; Boateng *et al.*, 2019; Wanyama *et al.*, 2019) and are willing to pay a premium price for nutritious and health attributes (including bio-fortified, fortified and GMO) in some cases only when the sensory attributes are not affected (De Groote *et al.*, 2018; Boateng *et al.*, 2019; Wanyama *et al.*, 2019). They also have a preference for sensory attributes (De Groote *et al.*, 2011; Jackson *et al.*, 2013; DeGroote *et al.*, 2014; Owusu *et al.*, 2017; Boateng *et al.*, 2019; Wanyama *et al.*, 2019) and for food safety (Lagerkvist *et al.*, 2013; Alphonce and Alfnes, 2017). Additionally, studies in Africa also report consumer preference for products origin (Alphonce and Alfnes, 2012; Demont and Ndour, 2015), with a strong preference for national products. Contrary to the studies from the Global North, that associate product origin with food miles (Akaichi *et al.*, 2016) and CO_2 footprint (Caputo *et al.*, 2013); consumer in Africa, like those in China (Xu *et al.*, 2018), associate product origin with consumer ethnocentrism and safety (Alphonce and Alfnes, 2012).

Furthermore, studies on novelty found that consumers are willing to pay a premium price for foods with novel attributes only when products are embedded with other quality attributes (Urala and Lahteenmaki, 2007; Kimenju and De Groote, 2008; Kikulwe *et al.*, 2011; Annunziata and Vecchio, 2013; Kraus, 2015; Owusu *et al.*, 2017; De Groote *et al.*, 2018; Boateng *et al.*, 2019; Jahn *et al.*, 2019; Wanyama *et al.*, 2019), and tradeoffs between the attributes depend on the functionality of the novel attributes (Urala and Lahteenmaki, 2003; La *et al.*, 2016). For example, De Groote *et al.* (2018) found consumers to increase their willingness to pay (WTP) for fortified foods when consumers receive nutrition information; also, Urala and Laatemaki (2003) reported that convenience and taste were key to acceptance of a functional food, but consumers were unwilling to trade off health for convenience. Mixed findings on tradeoffs between product attributes have also been reported. For example, Jonas and Beckmann (1998), Urala and Lähteenmäki (2007), De Groote *et al.* (2011), Meenakshi *et al.* (2012), Jackson *et al.* (2013), Birol *et al.* (2015), Kraus (2015), Oparinde *et al.* (2016), Boateng *et al.* (2019), Jahn *et al.* (2019) and Wanyama *et al.* (2019) report consumer unwillingness to trade off taste and sensory attributes for a novel products with nutritional or healthy benefits, while Tepper and Trail (1998) and La *et al.* (2016) reported consumers being willing to compromise taste and sensory quality for products with a health claims. In addition, Kimenju and De Groote (2008) and Kikulwe *et al.* (2011) report willingness to compromise their concerns about food/environmental and health safety of a novel technology like GM (genetically modified products) when the product has other potential benefits (like being nutritionally enriched or with other health benefits). Such studies also found consumer location, product type, brand, sensory taste, driven benefits (health, sensory, convenience, nutrition), education, gender, age, price, product knowledge, knowledge in science, type and source of health information to influence consumer WTP for novel foods (Urala and Laatemaki, 2003; Teratanavat and Hooker, 2006; Krutulyte *et al.*, 2008; Miele *et al.*, 2010; Annunziata and Vecchio, 2013; Kraus *et al.*, 2017; Banovic *et al.*, 2018; Okello *et al.*, 2018).

3. Study design and methods

3.1 Study objectives

Because of the changes in lifestyle and people's choices, consumers in urban and rural areas, both low- and high-income quintiles are purchasing more foods, including more convenience foods like highly processed and food away from home (Tschirley *et al.*, 2015). The current

study examines consumer preferences for processed food attributes in Tanzania, using baby food as a case study. Specifically, the study aimed to answer the questions on: what attributes do consumers look for in processed foods and how do consumers make tradeoffs between novel attributes and other attributes in processed foods.

3.2 Study design

3.2.1 Study area. The study was conducted in Dar es Salaam, Tanzania, in April 2017 in Ilala District. Dar es Salaam is a coastal mega-city, the largest in Tanzania, and one of the fastest growing in East Africa, with an estimated population of 5,115,698 (United Nations, 2018). Dar es Salaam was chosen because it has the largest consumer base for both low and highly processed foods from different origins and also because of its cosmopolitan nature and diversified economy (Tschirley *et al.*, 2015).

3.2.2 Sample. A total of 330 consumers attending a high-end supermarket or a traditional open market were asked to participate in a study on food-market decision-making. Only 317 consumers completed the hypothetical choice experiment, and 277 both the survey and the choice experiment. The high-end supermarket was chosen to obtain data on the preferences of high- and middle-income groups, while the traditional market was chosen to capture low-and mid-lower-income groups. Consumers at these markets were randomly selected and were asked two screening questions: (1) whether they usually used *lishe* flour and (2) whether they are involved in food decision-making. Only those who answered "yes" to both questions were invited to participate in the study.

3.2.3 Product. The processed baby food known as *lishe* (a Swahili word that translates as "nutritious food") was chosen because it is considered a nutritious and functional food; it is produced by both large-scale (local and imported) and small-scale processors, and it is also custom-milled (home-made) (Ijumba *et al.*, 2015). *Lishe* is a blend of flour mostly with ingredients rich in protein, carbohydrates and vitamins. It is largely used as a weaning food for infants above six months, but also as a nutritional supplement for the sick and the elderly.

The study included a choice between two 1-kg packets of *lishe* products differing in respect of six attributes: source of micronutrient ingredients (natural-added carrot and leafy vegetables vs artificial-fortified with vitamin A and iron); level of processing (low processed – need to cook vs high processed – no need to cook); origin (local – traceability, national – Tanzania, international – South Africa); Tanzania Bureau of Standards (TBS) [1] certification (certified vs not certified); protein source (none, soy, groundnut, fish); and price (3,000, 5,000, 7,000) (see Table 1 for detailed attributes and attribute levels).

In this particular study, we define highly processed and fortified attributes as novel attributes. In Tanzania, fortification was introduced to the public in 2013, after the fortification legislation of 2012 (TFDA, 2012). Although the fortification of wheat flour was implemented to scale by 2017, the average Tanzanian consumer purchases wheat products (than wheat flour) and so have no experience in choosing between a fortified or non-fortified product. They, however, buy maize flour and lishe, and thus have to make a choice about the novelty in the fortification attribute. For highly processed food, although there is penetration in both rural and urban markets (Tschirley *et al.*, 2015), these foods are considered novel because of their relative newness to the low-income and rural households, especially in baby foods and in particular *lishe* products (Reardon *et al.*, 2015).

Although other attributes, like the type of carbohydrate, might be important in determining consumer preferences for baby food, consumers were asked to make a choice between the two products with regard to their respective characteristics, the assumption being that all the other attribute levels not mentioned on the products were the same for all the alternatives.

3.2.4 The survey and experimental procedure. The study included a short survey and a hypothetical choice experiment, which were administered face to face by the primary author

Attributes	Levels
Source of micronutrient ingredients	(1) Natural-added carrot and leafy vegetables
	(2) Artificial-fortified with vitamin A and iron
	(3) No micronutrient ingredient added
Level of processing	(1) Low processed – need to cook
	(2) High processed – ready to eat
Origin	(1) Local – traceability
	(2) National – Tanzania
	(3) International – South Africa
TBS certification	(1) Certified
	(2) Not certified
Protein source	(1) No protein added
	(2) Fish
	(3) Nuts
	(4) Soy
Price	(1) 3,000
	(2) 5,000
	(3) 7,000

Table 1.
Attributes and levels used in the choice experiment

and a team of three trained researchers. The respondents started with the hypothetical choice experiment followed by the mini survey. The survey included background questions, revealed preference questions, including consumer's actual purchasing and consumption habits (buying versus processing their own *lishe* at home). Further, to be able to understand consumer's underlining preference and choices for different product attributes, a series of hierarchical question assessing the motivation underpinning consumer choices for different products attributes in form of ranking questions were administered. Approximately 40–60 min were used for the whole interview, including definition of the different product attributes and attribute levels, the choice experiment and the survey. After completion of the experiment and the survey, the participants were given a healthy snack as a way of appreciating their willingness to participate in the experiment.

To create the choice cards for the hypothetical choice experiment, we used the NGene software to generate a fractional factorial design with 36 profiles, which were divided into three blocks of 12 independent shopping scenarios. NGene reported a D-optimality of 96.78 percent (100 being the maximum) for the total design. For a description of the NGene software, see Metrics (2012).

During the experiment, participants were presented with 12 different shopping scenarios; in each shopping scenario, the participants were asked to choose from two product categories or opt out from choosing altogether (Hensher, 2010); see Table 1 for a description of attributes and attribute levels used in the choice cards.

Furthermore, to reduce the hypothetical bias, the participants were asked to consider their true incomes and any budgetary constraints while making choices; in addition, the lowest price was set at below the market price, while the highest price was limited to the highest market price for locally produced *lishe;* the opt-out option included in each shopping scenario also contributed to reducing the hypothetical bias.

3.3 Data analysis

The descriptive statistics revealed preference findings and the hierarchical questions are summarized as general descriptive results, while findings from the choice experiment are estimated using a random utility model. The attribute-based choice method is based on the Lancastrian consumer theory (Lancaster, 1966), which proposes that utilities for goods can be

decomposed into separate utilities with respect to their component characteristics or attributes and the random utility theory (McFadden, 1973) which assumes that rational consumers select the alternatives that give them the highest utility. Therefore, the probability of choosing an alternative is higher if the utility provided by the alternative is the highest among the different choices. Thus, individual i's utility (i = 1 to 317) associated with the choice of alternative j (j = alternative 1, alternative 2 and the opt-out option) in choice occasion t (t = 1–12) is presented as:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \tag{1}$$

where U_{ijt} is the latent unobservable utility that the ith consumer obtains from choosing either of the two products or opting out; V_{ijt} is deterministic and is the utility function that the researcher models; and ε_{ijt} is the stochastic portion of the utility.

$$\text{where } V_{ijt} = X_{ijt}\beta_j \tag{2}$$

The betas are the utility parameters, where β_{1i}, β_{2i}, β_{3i}, β_{4i}, β_{5i}, β_{6i}, β_{7i}, β_{8i}, β_{9i} are random parameters, and β_{10i} (price) is a fixed parameter. X_{jt} are the product profiles with two two-level categorical attributes: TBS certification (x_{1ijt}: 1 = certified with TBS, 0 not certified with TBS), level of processing (x_{2ijt}: 1 = Highly processed, 0 low processed) and three three-level categorical attributes coded as a series of dummies: fortification (x_{3ijt}: 1 = artificial-fortified with vitamin A and iron; x_{4ijt}: 1 = natural-added with carrot and green leafy vegetables, 0 no any micronutrient ingredients added), origin (x_{5ijt}: 1 = local-trace-processor; x_{6ijt}: 1 = international-South Africa, 0 national-Tanzania) and protein source, also coded as a series of dummies (x_{7ijt} 1 = soy; x_{8ijt} 1 = groundnuts; x_{9ijt} 1 = fish, 0 no any protein ingredients added) and price (x_{10ijt} is the price of alternative j).

The data were analyzed with the random parameter logit model (a mixed logit) (McFadden and Train, 2000) in equation (3)below:

$$\begin{aligned} U_{ijt} = {} & \beta_{oj} + \beta_1 \text{TBS.Certified}_{ijt} + \beta_2 \text{Highly processed}_{ijt} + \beta_3 \text{A.fortified}_{ijt} + \beta_4 \text{N.fortified}_{ijt} \\ & + \beta_5 \text{Traceability}_{ijt} + \beta_6 \text{South Africa}_{ijt} + \beta_7 \text{Soy}_{ijt} + \beta_8 \text{Nuts}_{ijt} + \beta_9 \text{Fish}_{ijt} + \beta_{10} \text{Price}_{ijt} \\ & + \varepsilon_{ijt} \end{aligned} \tag{3}$$

where β_{oj} is the alternative specific constant (ASC) representing the no buy option choice with a value of 1 for Alternatives 1 and 2, and 0 for opting out; TBS.Certified$_{ijt}$ is a dummy variable taking the value of 1 if the product is inspected and said to meet the standards set by the TBS, and 0 otherwise; Highly processed$_{ijt}$ is a dummy variable taking the value of 1 if the product is highly processed (no need to cook), and 0 otherwise; A.fortified$_{ijt}$ is a dummy variable taking the value of 1 if the product is fortified with vitamin A and iron, and 0 otherwise; N.fortified$_{ijt}$ is a dummy variable taking the value of 1 if a product is added with carrot and green leafy vegetables, and 0 otherwise; Traceability$_{ijt}$ is a dummy variable taking the value of 1 if a product can be traced back to the local supplier, and 0 otherwise; South Africa$_{ijt}$ is a dummy variable taking the value of 1 if the product is imported from South Africa, and 0 otherwise; Soy$_{ijt}$ is a dummy variable taking the value of 1 if the product contains protein from soy, and 0 otherwise; Nuts$_{ijt}$ is a dummy variable taking the value of 1 if the product contains protein from groundnuts, and 0 otherwise; Fish$_{ijt}$ is a dummy variable taking the value of 1 if the product contains protein from fish, and 0 otherwise; and Price$_{ijt}$ is the price for alternative j; ε_{ij} are iid are extreme value distributed error terms. The model is estimated with the mixlogit command in STATA 14.

To calculate the WTP, we transfer the results of the random utility model to a money metric WTP value, by dividing all the random parameters from the random utility model by the negative of the price parameter, see equation (4):

$$\overline{\mathrm{WTP}_j} = -\left[\frac{\beta^{\circ}}{\beta_{10}} + \frac{\beta_1}{\beta_{10}}\mathrm{Certification} + \frac{\beta_2}{\beta_{10}}\mathrm{Process.H} + \frac{\beta_3}{\beta_{10}}\mathrm{A.fortified} + \frac{\beta_4}{\beta_{10}}\mathrm{N.fortified} + \frac{\beta_5}{\beta_{10}}\mathrm{Trace} + \frac{\beta_6}{\beta_{10}}\mathrm{SA} + \frac{\beta_7}{\beta_{10}}\mathrm{Soy} + \frac{\beta_8}{\beta_{10}}\mathrm{Nuts} + \frac{\beta_9}{\beta_{10}}\mathrm{Fish}\right] \quad (4)$$

Further, to obtain meaningful WTP values, we divide all the prices by a constant 10. Additionally, further estimation of the model was done on two different income levels, age and education levels.

4. Results

4.1 Characteristics of the sample

The participants in this study were characterized by a significant number of women (82 percent), elderly youth (34years), lower-medium-income consumers (350,000/month), households with an average of five members, households with children under five years (53 percent) and consumers of *lishe* products (42 percent purchaser vs 58 percent non-purchasers [2]).

A summary of the socio-demographic characteristics of the participants is presented in Table 2. As indicated in Table 2, the sample is not a representative of all segments of the Dar es Salaam or Tanzania population, but this segment is particularly interesting to study in the perspective of baby food (or *lishe* products). First, women are the primary food shoppers and food decision makers in households in Africa (Ilkay, 2013); second, the study design aims at understanding the dynamics of both low- and medium-high income consumers, 41 percent of the sampled consumers included low-income consumers (with an average income of TSh180,040/month); and third, the type of customers (using *lishe* products and who are decision makers in the family) are likely to be older than the population median.

Sample Descriptive	Mean/(median)	Min	Max	National census Mean
Age	34 (34)	19	57	17.7*
Gender				
Female	82%			51%
Male	18%			49%
Income	511,282 (350,000)	25,000	10,000,000	189,154
Low (<=300,000)	180,040 (150,000)	25,000	250,000	
High (>300,000)	779,739 (450,000)	350,000	10,000,000	
Household size	5 (5)	1	12	4.8
Purchasers	42%			
Non-purchasers	58%			

Note(s): Purchasers are consumers who buy *lishe* products, while non-purchasers are consumers who process/blend their own *lishe* at home; *the median is reported
Source(s): United Nations, 2018

Table 2. Socio-economic characteristics

4.2 Purchasers versus non-purchasers

Despite the massive number of brands selling baby food in the market (Ijumba *et al.*, 2015), over a half (58 percent) of all respondents custom-milled, i.e. process their own baby food (in this study, referred to as non-purchasers), while the rest (42 percent) purchased or did both, i.e. sometimes purchase, other times, custom-mill (in this study, referred to as purchasers). The study revealed some of the reasons as to why consumers custom-mill their own baby food, despite availability in the market being: trust in quality (cleanliness), freedom to include ingredients of their own choice (for taste and nutrition), lack of trust in the nutritional quality of products in the market and trust in quality (safety) (Table 3).

On the other hand, consumers who purchased baby food reported choosing specific brands because of: the ingredients included (for taste and/or nutrition), sensory taste, better quality (safety), trust in the processor or brand and nutritional quality, in that order (Table 4). Processed food purchasers who care about quality used the processor or brand to signal quality for taste, nutrition and safety. Overall, preferences for nutrition, food safety and sensory taste stood out as important attributes for both purchasers and non-purchasers in the descriptive results (Tables 3 and 4).

4.3 Preference for processed foods in general

Corroborating the findings from Kraus (2015) and Hall and Osses (2013), the study revealed that freshness (production date), nutrition and naturalness are the top three attributes that consumers look for when buying processed or packaged food. On unveiling the motivations behind choices, the consumers reported to be not very keen on the product origin (Table 4) when buying processed products (although their stated preference in the choice experiment revealed otherwise). This concurs with other studies that found product origin to be unimportant (e.g. Lusk and Briggeman (2009)), but contradicts studies where product origin is very important (Alfnes and Alphonce, 2012 Akaichi *et al.*, 2016; De Magistris and Gracia, 2016; Gracia and De Magistris, 2016; Xu *et al.*, 2018) (Tables 5 and 6).

Notwithstanding the above, and in line with (Alfnes and Alphonce, 2012 Akaichi *et al.*, 2016; De Magistris and Gracia, 2016; Gracia and De Magistris, 2016; Xu *et al.*, 2018) the results from the choice experiment in Tables 7 and 8, we find product origin as an important attribute in consumer preference. From the model estimates, consumers discount products from South Africa compared to products from Tanzania, and the results are highly significant ($p < 0.01$) across all income, age and education groups. Consumers are willing to pay up to TZS1,839 to avoid a product from South Africa. When asked the motivation behind their choices for product origin, consumers reported to discount imported products (from South Africa) because they are likely to contain more chemicals (Table 9). This is likely so because of the common perception that foods that came from miles away are likely to contain more added

Table 3.
Factors contributing to processing own baby food *(lishe)*

Motivation for acquiring own *lishe*	Rank 1	Rank 2	Rank 3	Total score
1. Trust in quality (cleanliness)	45 (20%)	64 (31%)	34 (19%)	297
2. The freedom to include ingredients of their own choice	56 (25%)	42 (20%)	37 (21%)	289
3. Lack of trust in the nutritional quality of products in the market	58 (26%)	31 (15%)	18 (10%)	254
4. Trust quality (safety)	34 (15%)	24 (12%)	57 (32%)	207

Note(s): Out of the statements used to asses contributing factors, only the top hree in Ranks 1, 2 and 3 are shown in this table
The first, second and third ranks are given a score of 3, 2 and 1, respectively

preservatives to prolong shelf life. The reported motivations are in line with studies reporting consumer preference for their own country of origin, where food quality/safety and ethnocentrism drive their preference (Alphonce and Alfnes (2012); Xu *et al.*, 2018).

4.4 Preference for attributes in baby food and tradeoffs with novel attributes

In line with De Groote *et al.* (2018) and Wanyama *et al.* (2019), we find consumers to generally have a strong preference for nutritionally enhanced foods (i.e. they prefer added micronutrients and protein ingredients to no added ingredients). Furthermore, this study finds that consumers: first, have preference for the type of ingredients included in their baby food; and second, have a stronger preference for baby food with added natural than artificial ingredients (prefer added vegetables rich in iron and vitamin A to artificial fortification) (Table 7). These findings are in line with Amunar *et al.* (2000), Banovic *et al.* (2018) and Clark *et al.* (2019), but contradict De Groote *et al.* (2018) who report no difference in WTP for artificially and naturally fortified pearl millet products, and Wanyama *et al.* (2019) who report consumers to be willing to pay more for flour added with artificial fortification than flour added bio-fortified or natural micronutrient ingredients (such as green leafy vegetables).

Consumers also preferred baby food with added protein from nuts and soy to baby food with added protein from fish (Table 7). Except for young and high-income consumers, preferences for baby foods with added fish, though positive, were mostly insignificant across

Attitude toward *lishe* brands	Rank 1	Rank 2	Rank 3	Total scores
1. Ingredients	28 (25%)	24 (23%)	13 (14%)	145
2. Taste (tasty and aromatic)	22 (20%)	21 (20%)	15 (16%)	123
3. Better quality (safety)	18 (16%)	17 (16%)	12 (13%)	100
4. Trust processor	17 (15%)	16 (15%)	13 (14%)	96
5. Better quality (nutrition)	16 (14%)	10 (10%)	18 (19%)	86

Note(s): Out of the statements used to assess factors influencing the purchase of baby food brands, only the top three in Ranks 1, 2 and 3 are shown in this table
The first, second and third ranks are given a score of 3, 2 and 1, respectively

Table 4.
Factors influencing the purchase of baby food

Attributes	Rank 1	Rank 2	Rank 3	Total score
1. Life span/production date	77 (30%)	67 (27%)	42 (18%)	407
2. Nutrition content	82 (32%)	48 (19%)	32 (14%)	374
3. Naturalness	37 (14%)	38 (15%)	39 (17%)	226

Note(s): Out of the listed attributes, only the top three in Ranks 1, 2 and 3 are shown in this table
The first, second and third ranks are given a score of 3, 2 and 1, respectively

Table 5.
Important attributes when buying processed food

Attributes	Rank 1	Rank 2	Rank 3	Total score
1. Origin	95 (46%)	32 (16%)	23 (12%)	372
2. Cholesterol-free/trans-fats	39 (19%)	65 (29%)	56 (28%)	303
3. Brand/processor know	23 (11%)	42 (21%)	8 (4%)	161

Note(s): Out of the listed attributes, only the top three in Ranks 1, 2 and 3 are shown in this table
The first, second and third ranks are given a score of 3, 2 and 1, respectively

Table 6.
Insignificant attributes when buying processed food

Table 7.
Results from the economic model by income and education

Variable	Coefficient	Income		Education		Age	
	All (N = 317)	Low (n = 124) (<=300,000)	High (n = 153) (>300,000)	Low (n = 98) (None-primary)	High (n = 175) (Secondary-postgraduate degrees)	Young (n = 139) (<35)	Older (n = 136) (> = 35)
Price	−0.000285* (0.000166)	0.000113 (0.000259)	−0.0006545** (0.000223)	−0.000438 (0.000322)	−0.000309* (0.000200)	−0.000137 (000229)	−0.000403* (0.000233)
Protein source							
Soy.1	0.737*** (0.0964)	0.688*** (0.154)	0.794*** (0.122)	0.882*** (0.184)	0.657*** (0.113)	0.729*** (0.146)	0.664*** (0.116)
Nuts.1	1.067*** (0.0923)	1.129*** (0.149)	1.128*** (0.128)	1.118*** (0.191)	1.053*** (0.112)	1.085*** (0.125)	1.028*** (0.139)
Fish.1	0.149 (0.110)	0.113 (0.114)	0.266* (0.144)	0.173 (0.205)	0.170 (0.133)	0.447** (0.148)	−0.0625 (0.161)
Artificial (fortified vitamin A and iron)	0.150** (0.0717)	0.385*** (0.114)	−0.00299 (0.103)	0.230 (0.144)	0.184** (0.0909)	0.270** (0.105)	−0.00923 (0.0969)
Natural (enriched vitamin A and iron)	0.959*** (0.0820)	1.127*** (0.136)	0.939*** (0.107)	1.484*** (0.183)	0.880*** (0.0927)	1.209*** (0.116)	0.678*** (0.107)
Level of processing							
Highly processed.1	−0.598*** (0.0620)	−0.622*** (0.102)	−0.589*** (0.0766)	−0.643*** (0.123)	−0.598*** (0.0620)	−0.668*** (0.0840)	−0.461*** (0.0822)
Origin							
Traceability.1	0.117 (0.0726)	0.234** (0.114)	0.119 (0.0985)	0.351** (0.137)	0.0624 (0.0925)	0.169* (0.100)	0.0901 (0.106)
South Africa.1	−0.524*** (0.0775)	−0.512*** (0.121)	−0.554*** (0.108)	−0.651*** (0.151)	−0.470*** (0.0900)	−0.433*** (0.110)	−0.586*** (0.105)
TBS.Certified.1	0.515*** (0.0563)	0.490*** (0.0972)	0.553*** (0.0713)	0.410*** (0.106)	0.600*** (0.0704)	0.501*** (0.0738)	0.482*** (0.0788)
ASC-1 (if alt1&2)	2.889*** (0.263)	2.340*** (0.357)	3.352*** (0.387)	2.180*** (0.368)	3.219*** (0.344)	2.065*** (0.303)	4.810*** (0.627)

Note(s): Significant results *p < 0.10; **p < 0.05; ***p < 0.001; SE in parenthesis; although 317 consumers completed the choice experiment, only 277 completed the survey

Product	Product attribute	MWTP
Protein source	Soy	2,588*
	Nuts	3,743*
	Fish	523
Source of micronutrient ingredients	Natural-added carrot and leafy vegetables	3,365*
	Artificial-fortified with vitamin A and iron	524
TBS certification	Certified	1,807*
Origin	Local	409
	South Africa	−1,839*
Level of processing	Highly processed	−2,098*
ASC-1	Alt1&Alt2	10,140*

Note(s): Marginal WTP (MWTP) is the average amount consumers are willing to pay extra to get an attribute
Significant results *$p < 0.10$

Table 8.
WTP results

	Rank 1	Rank 2	Rank 3	Score
Product origin				
1. Knowing the processor is important – signals quality	106 (39%)	89 (39%)	44 (23%)	540
2. The origin signals food safety and quality	39 (14%)	76 (33%)	59 (30%)	328
3. Imported products are likely to have more added additives like GMOs and preservatives	43 (16%)	21 (9%)	29 (15%)	200
4. The origin of a product is not important	49 (18%)	11 (5%)	24 (12%)	193
Protein source				
1. Nuts are rich in proteins and fats	66 (30%)	48 (25%)	23 (13%)	317
2. Nuts add an aroma and flavor to *lishe*	38 (17%)	56 (29%)	25 (14%)	251
3. Fish gives an odd smell in *lishe* mixture	45 (20%)	17 (9%)	10 (6%)	179
4. Soy is rich in protein and very healthy	15 (7%)	28 (15%)	60 (35%)	161
5. Soy has a lovely aroma and taste	3 (1%)	16 (8%)	29 (17%)	70
Level of processing				
1. Minimally processed products are healthier, no additive added	83 (31%)	123 (61%)	74 (43%)	569
2. Highly processed is unhealthy, unsafe, has a lot of additive	115 (43%)	47 (23%)	61 (35%)	500
3. Highly processed products are easy to prepare (offer convenience)	40 (16%)	9 (4%)	10 (6%)	148
4. Highly processed are expensive	5 (2%)	10 (5%)	18 (10%)	53
Source of micronutrient ingredients				
1. Added artificial fortificants are not natural, can have long-term side effects	133 (50%)	180 (77%)	100 (58%)	859
2. A balanced diet can provide the nutrients and micronutrients needed, there is no need of fortifying food	83 (31%)	29 (12%)	49 (28%)	356
3. Added micronutrient is what matters, not the source of the added micronutrients	31 (12%)	5 (2%)	6 (3%)	109
4. Artificial fortification can help to improve overall health	17 (6%)	21 (10%)	17 (10%)	110
TBS certification				
1. Certification infer quality and safety	113 (42%)	132 (60%)	3 (3%)	606
2. Trust certification to ensure a nutritious product	133 (50%)	83 (37%)	1 (1%)	566
3. Do not trust the authority certifying	13 (5%)	5 (2%)	1 (1%)	50

Note(s): Out of the statements used to asses motivating factors, only the top three in Ranks 1, 2 and 3 are shown in this table
The first, second and third ranks are given a score of 3, 2 and 1, respectively

Table 9.
Motivation behind choosing an attribute

education, income and age. While nuts and soy were preferred because of their healthiness, good flavor and aroma, fish was discounted because of its bad sensory taste (odor) (Table 9), further underlining the value of sensory attributes among consumers (Urala and Lahteenmaki, 2007; Kraus, 2015; Boateng *et al.*, 2019; Wanyama *et al.*, 2019).

Further, the results in Table 7 show that young ($p < 0.01$), low-income ($p < 0.01$) and consumers with high education ($p < 0.05$) are more likely to accept fortified foods than middle- to high-income ($p > 0.10$), older ($p > 0.10$) and consumers with low levels of education ($p > 0.10$). The results suggest that educated consumers might be more knowledgeable about novel technologies or more aware of the role of diet in maintaining a healthy life. Similar findings were reported by Pitman and Reinhardt (2000), Krutulyte *et al.* (2008), Miele *et al.* (2010), Annunziata and Vecchio (2013) and La *et al.* (2016).The low-income consumers, while might or might not be knowledgeable, are likely to have poor access to nutritious meals and are hence most likely to accept fortified foods to prevent their children from contracting diseases related to micronutrient deficiencies. The young, on the other hand, could be more open-minded and thus more open to new and high-level technologies (Kraus *et al.*, 2017; Banovic *et al.*, 2018).

We further find that consumers have a stronger preference for familiarity (product/attributes they already know, i.e. lowly processed and product with no fortificants) over novel attributes like fortification and highly processed products. Their preference for familiarity is easily traded off when a novel product is embedded with important quality attributes like nutrition, i.e. they prefer the novel nutrition attribute (e.g. prefer fortified products) over their preference for familiarity (products with no fortificants). However, consumers do not seem to trade off their preference for familiarity when the novel attribute is embedded with less important quality attributes such as convenience (highly processed offer convenience as it is ready to eat). Consumers are willing to pay a premium of up to TZS2,098 to avoid highly processed baby foods (Table 8), a discount found across all education, age and income groups (Table 7). The findings of this study corroborate those of Dannenberg (2009),who found that consumers discount less the GMO products with a health claim than they did those with no health claim, and De Groote *et al.* (2018), who found consumers to increase their WTP for fortified foods (both natural and artificial) when consumers were given health information(see also Lusk *et al.*, 2005). Contrary to our findings, Urala and Lähteenmäki (2003) found convenience as important for choosing a functional food.

The results in Table 7 further show that consumers in all income, education and age groups highly value products certified to meet the standards set by the TBS ($p < 0.01$). Consumers are willing to pay up to TZS1,807 more for a certified product (Table 8). These results are in line with Jiao *et al.* (2016), who found certification and traceability as the most important product characteristic among Chinese pork consumers, and Owusu *et al.* (2017), who reported safety and taste to be the most important attributes for the acceptance of cassava-wheat composite bread in Ghana. This study further signifies the importance of assured food quality aspects for consumers in Tanzania, an assurance that is currently missing in many of the small-scale food processors.

5. Conclusion

This paper explored consumer preferences for attributes in processed foods based on data collected at a high-end supermarket and a traditional local market in Dar es Salaam, Tanzania, from 317 respondents. Consumers are found to be reluctant to adopt new or novel technologies when buying processed foods, especially so when buying processed foods for their babies. *Lishe* consumers have a strong preference for natural (i.e. prefer and are willing to pay significantly more for added natural micronutrients to artificial fortification), nutritious (i.e. prefer and are willing to pay more for added protein and micronutrient

ingredients to no added protein or micronutrients ingredients), tasty (i.e. prefer nuts and soy for their aroma and discount fish for its odd smell) and quality food (i.e. prefer lishe that is certified by TBS to non-certified; also associate origin with food quality and safety). However, they are willing to trade off their preference for naturalness (and also bear the uncertainty associated with novel products) for a novel attribute when it is embedded with quality benefits such as nutrition, but not, such attributes as convenience. The sensory taste of the product is also found to be very important, as consumers choosing baby food attributes are sometimes willing to trade off the nutritional attributes over sensory taste.

Although the results revealed a clear low preference for novelties such as food fortification, the importance of nutrition (i.e. consumers can trade off familiarity for nutrition) sheds a light on the potential for the penetration of fortified foods in Tanzania and their acceptance by consumers. These results have implications for the policy strategists, policy-makers and practitioners involved in nutrition programs and development. Acceptance of fortified foods among low-income consumers implies that a portfolio of premixed and fortified food products with traditional high demand could have significant market and nutritional benefits.

Consumers' preference for product origin suggests a strong preference for processed foods from Tanzania relative to imported processed foods, for example, from South Africa. This suggests a potential for growth and expansion of the domestic agro-processing sector where currently the number of agro-food processing firms is still low, seriously limiting the scope of resource-based industrialization and non-farm employment. The finding on preference for processed foods from a particular origin points toward labeling and brand development as strategic tools for market penetration of local agro-food processors.

Notwithstanding the statistical robustness of the findings of this study, further research is needed to increase our understanding of whether consumer preferences with respect to product origin and novelty are specific to baby foods or persist across other processed food categories. Furthermore, approximately 58 percent of all participants custom-milled their *lishe* products; hence, their inexperience in purchasing the product might have led to under or over-estimating product attributes. Although we controlled for a hypothetical bias, having a hypothetical choice experiment with non-shoppers could have triggered the hypothetical bias, making participants concentrate more on non-price than price attributes.

Notes

1. TBS is stamped on a product when the product meets the national and international standards set by the TBS.
2. Purchasers are those who buy lishe blend, while non-purchasers are those who buy ingredients and process/blend their own *lishe* at home.

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