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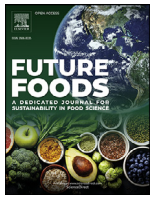

Consumer perceptions of plant based beverages: The Ghanaian consumer's perspective

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ABSTRACT

This study identified factors influencing consumer desirability for a concept beverage from tiger nut milk and cocoa pulp using qualitative focus groups with four demographic groups: mothers, young adults, adults, and middle-aged adults. Specifically, Ghanaian consumers' knowledge of plant-based beverages (PBB), sensory attributes driving preferences and selection, and willingness to purchase were investigated. Focus group discussions were thematically analyzed by Attride-Stirling's method using ATLAS.ti.7 software. Most consumers were knowledgeable of PBB. Health and nutrition were main drivers of consumption while taste, cost, availability, and culture were barriers to consumption. Drivers of consumer preference of PBB differed across demographic groups. Environmentally conscious consumers (mothers, adults, and middle-aged) preferred paper packaging while young adults preferred plastic packaging for convenience. Middle-aged adults preferred unsweetened versions for health reasons and mothers preferred unflavoured PBB for their children. Consumers expressed willingness to purchase the concept beverage, citing innovation, taste, and health benefits as main drivers.

Industrial Relevance: Increased consumer awareness of the relationship between diet and disease and the importance of consuming healthful foods has informed a switch to more plant-based diets. Our results provide valuable insights to facilitate the development of an acceptable plant-based beverage for Ghanaian consumers.

1. Introduction

Major advancements in food product development have typically been directed towards addressing the evolving needs and demands of consumers by developing alternatives to existing food products. Specifically in the milk sector, increasing consumer concerns about lactose intolerance, environmental impact of dairy production coupled with increasing preference for plant-based diets has led to a surge in the consumption of plant-based beverages (Swati et al., 2016; McClements *et al.*, 2020). Plant-based beverage is a generic term for fluid extracts of cereals, nuts, legumes, and seeds that are similar in appearance and consistency to cow's milk. These beverages are lactose and cholesterol free and are thus, considered to be healthy alternatives to dairy milk. Additionally, they are generally less expensive compared with dairy milk making them a good alternative for developing economies and regions where cow milk supply is inadequate (Swati et al., 2016). Popular plant-based beverages include soymilk, almond milk, and coconut milk. Consumers will fully adopt plant-based milk alternatives only if they function in a similar manner to dairy milk (McClements et al., 2020). It is therefore not surprising that despite the advantages and health benefits associated with the consumption of plant-based beverage, consumers are often apprehensive about adopting plant-based beverage due to undesirable sensory properties such as taste, color, and mouth feel. Additionally, in comparison with dairy milk, plant-based beverage alternatives may lack important nutrients such as calcium and vitamin D which may influence the decision of consumers to change their diets and include more plant-based milk options (Pratt, 2020). Due to these challenges, consumers still often prefer dairy milk over plant-based milk alternatives (Palacios et al., 2010; Makenin et al., 2016). According to Pratt (2020), one major opportunity for improving the sensory and nutritional challenges associated with plant-based milk alternatives is to combine two or more plant sources in the development of plant-based foods and beverages to leverage on the different physicochemical and sensory properties.

As the consumer segment becomes increasingly heterogeneous and unconventional, it has become more challenging for food product developers to understand and predict consumer food choices (Grasso et al., 2023). Studies have reported that between 50–80% of new food prod-

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ucts either never make it to the market or fail within one year of being introduced to the market (Salnikova et al., 2019). The consumer-led approach to new food product development is a market-oriented technique that allows food product developers to integrate consumer insights throughout the development process. This facilitates the production and prediction of acceptable new food products that address consumer needs (Case, 2013). This differs from traditional product development in that engineers and manufacturers do not rely solely on their own expertise or opinions. Under this approach, identifying consumer needs is the starting point of the product development process. Qualitative methods such as focus groups, empathic design and lead user design are often employed in consumer research as these provide deeper insights into consumer needs (Schifferstein, 2015). Focus groups are frequently used in the initial stages of product development to gain in-depth understanding of consumer needs, explore, and identify new concepts and opportunities. In order to achieve the intended aim of improving the quality of new product ideas, research recommends a systematic incorporation of the resulting information to guide the food development process (Bogue and Repar, 2022). Thus, this study sought to explore Ghanaian consumers' perspectives of plant-based beverages and obtain consumer insights on a product concept to inform further research on the development of an acceptable plant-based beverage from tiger nut and cocoa pulp.

The research adopted a qualitative approach and was guided by the following questions: 1) What factors influence the desirability of plant-based beverages for Ghanaian consumers? 2) What factors constitute barriers to the consumption of plant-based beverages? 3)What attributes are considered critical for a plant-based beverage?

This study is one of very few studies conducted in Ghana that considers factors that influence consumer acceptance of plant-based beverages and also adopts a consumer-led approach in the development of a new food product.

2. Methodology

2.1. Focus group discussions

Focus group discussions (FGDs) were conducted with the aim of exploring and understanding factors that influence consumer acceptability of plant-based beverages. Additionally, it adopted a participatory, co-creation approach to elicit consumers' perceptions of a beverage concept based on tiger nut milk and cocoa pulp to inform the development of the beverage in the second phase of the research. Studies on consumer attitudes and perceptions use various qualitative methods including focus group, concept mapping and individual interviews (Su and Canavari, 2018). Focus group discussions were selected for this study based on its reported efficiency in highlighting the full extent of participants' perspectives (Maitiniyazi and Canavari, 2020). Additionally, it provides participants an opportunity to build on their opinions as a follow up to opinions raised by other participants. Belk et al. (2013) indicated that the data is generated through participant interactions thus allowing for closer observations of points of consensus and/or disagreements of the topic under discussion.

2.1.1. Recruitment procedure

The partial closure of the study location (University of Ghana) due to the COVID-19 pandemic necessitated the use of both virtual and physical sessions for the Focus Group Discussions (FGDs). This facilitated the recruitment of participants and allowed the adherence to strict COVID-19 protocols. Recruitment forms were shared via varied online platforms to recruit participants for both the physical and virtual sessions of the FGDs. Persons who completed the online recruitment forms were contacted ahead of the FGDs to confirm their attendance, as well as their preferred session (online or physical) for the FGDs.

Table 1
Description of focus group participants.

Demographic group	Number of participants	Type of Session	Description
	9	Virtual	FGD 1
Young Adults	9	Virtual	FGD 5
	12	Physical	FGD 6
	12	Virtual	FGD 2
Adults	8	Virtual	FGD 3
	10	Physical	FGD 7
	7	Physical	FGD 10
Middle Aged	6	Physical	FGD 11
	8	Physical	FGD 12
	9	Physical	FGD 13
	8	Virtual	FGD 4
Mothers	10	Physical	FGD 8
	12	Physical	FGD 9

2.1.2. Participants

Inclusion criteria for the study were: consumers of plant-based beverages and dairy milk aged between 18 and 65 years, willingness to participate in the study, either staff or students of the University of Ghana, and fluent in English. The FGDs were conducted with a total of 120 respondents at the Food Product Development Laboratory and the Joana Nsarko Foods Laboratory of the Department of Family and Consumer Sciences (University of Ghana). Participants were categorised into four demographic groups with 30 participants (Mason, 2010) in each as follows:

a Young adults (18 - 24 years)
b Adults (25 - 45 years)
c Middle aged (46 - 65 years)
d Mothers (with children aged 5 - 9 years)

Participants were asked to sign a consent form and were given the opportunity to ask for clarification before their sessions began.

2.2. Data collection and analysis

The FGDs were conducted with a semi-structured interview guide with two (2) researchers present: one moderator and one observer, who also took handwritten notes. Additionally, sessions were recorded using an audio recorder or a computer. There was a total of thirteen (13) sessions. Five (5) FGDs were conducted virtually (using the ZOOM platform) with the remaining 8 sessions being in-person (Table 1). Each session had a minimum of six and a maximum of twelve participants in line with best practice (Lichtman, 2014) and lasted no longer than seventy-five (75) minutes. All COVID-19 safety protocols (social distancing, masks, etc.) were strictly adhered to during the in-person sessions.

The main areas of discussions were participants' knowledge of general attributes of dairy milk products, their experiences with plant-based beverages and perceptions of a proposed composite plant milk beverage. Sample questions from the interview guide are presented in Table 2.

Audio data were transcribed to obtain verbatim responses and compared with handwritten notes that were taken during each session.

Data analysis of the transcribed data was done with the aid of the ATLAS. TI. 7 software. Massey (2011) listed thematic analysis as one of three methods for analysing data from focus group discussions and was also considered as the most commonly used method. Following the thematic network analytical approach described by Attride-Stirling (2001), the responses from the discussions were coded into basic themes, organizing themes, and global themes.

Trustworthiness of the data was established using the criteria defined by Guba and Lincoln (1989). These are credibility (frequent verbal checks during discussion to confirm responses), transferability (participant demographics provided, verbatim quotes), dependability (semi-structured interview guide, audio recordings, data transcription) and confirmability (audit trail of data analysis).

Table 2
Interview guide to facilitate focus group discussions.

Topic	Guiding Questions (Sample)
General attributes of dairy milk products	• What do you understand by the term "milk"? Can you give any examples? • What are key attributes you consider when purchasing a milk product? • What is your preferred packaging for milk beverages?
Plant-based beverages	• What does the term "Plant-Based Milk" mean to you? • Do you know of/consume any plant-based milk beverages? • Do you know of any benefits associated with the consumption of plant-based milk as part of your diet? • What are some barriers to the purchase/consumption of PBM beverages?
Beverage concept - composite plant-based beverage	• Have you heard of cocoa pulp or its use in beverages? • Do you consume tiger nuts? In what form? • What are your thoughts of a cocoa pulp and tiger nut milk beverage? • What features would you want incorporated in the beverage to give the product a competitive advantage? E.g., packaging, taste, color, flavor, etc. • Would you be interested in purchasing this beverage if it was available on the market? Yes/No? Why??

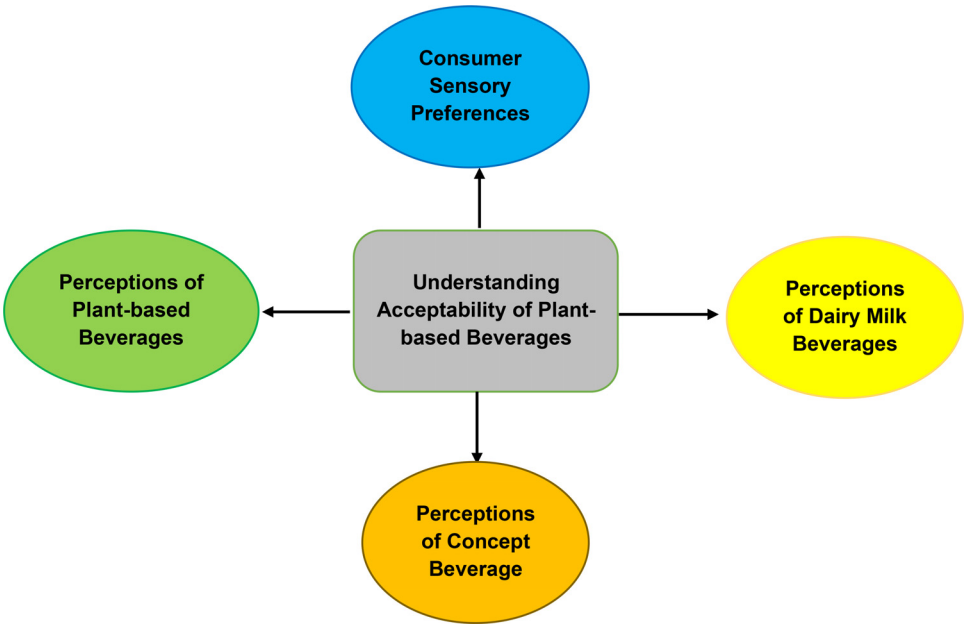

Fig. 1. Understanding factors that influence consumer acceptability of plant-based beverages. Illustrates the global and organizing themes of factors influencing consumer acceptability of plant-based beverages.

3. Results & discussions

The consumer FGDs centered on factors that influence consumer liking of plant-based beverages and elicited consumer perceptions of a beverage concept based on tiger nut milk and cocoa pulp. The thematic analysis of responses from the focus group discussions yielded a global theme of "understanding the acceptability of PBB" which could be further categorized into sub-themes based on feedback from the focus groups (Fig. 1).

3.1. Consumer perceptions of dairy milk

Under this topic, consumers were interviewed on their understanding of the term *dairy milk*, their mode of consuming dairy milk and their reasons for consumption. The thematic analysis of the response is summarized in Fig. 2. It was observed in all four demographic groups that consumers mainly defined dairy milk as any beverage product composed primarily of cow's milk. Others defined it generally to be a liquid drink that has cow's milk as one of the main ingredients. A few participants also described milk beverages as "diluted milk" or a drink with a milky taste. Additionally, consumers stated that milk beverages could either be in a liquid or powdered form. Often, consumers used the term "milk drink" interchangeably with "milk beverage". Popular milk products that were mentioned included local brands of evaporated milks, flavoured milk, "*Burkina*" (a local beverage made from fermented cow's milk and cooked millet), and yoghurt.

3.1.1. Mode of consumption

Generally, two main modes of consumption were identified: as a creamer and/or snack (Fig. 2). A typical mode of consumption was the use of dairy milk beverages as a creamer. In all four groups, consumers mentioned that they preferred to use milk beverages, most often referring to evaporated milk, as creamers mainly with their breakfast dishes such as oats, tea, porridge, etc. Participants also reported that they con-

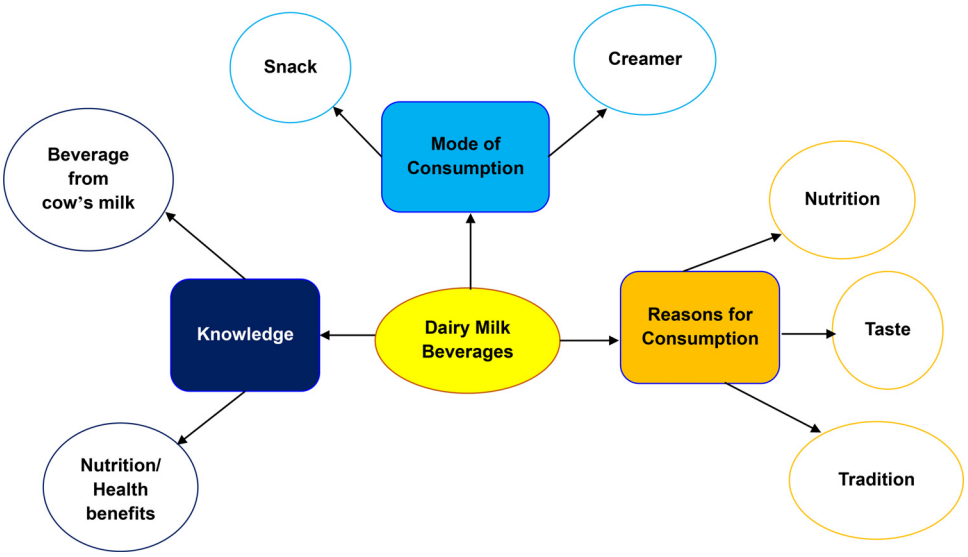

Fig. 2. Consumer perceptions of dairy milk beverages. Illustrates factors that influence the acceptability of dairy milk beverages among consumers. The study explored factors including reasons for consumption, knowledge of dairy milk beverages and mode of consumption.

sumed their milk beverages as a snack, alone or with biscuits or other pastries. According to McClements et al. (2020), consumers use dairy milk in a variety of ways. This includes consuming such beverages as a snack or as a creamer in other beverages including tea, coffee and with cereals.

3.1.2. Facilitators to the consumption of dairy milk

The reasons for consuming dairy milk beverages as reported by consumers in all groups included taste, nutrition/health, and tradition/culture. Participants stated that they enjoyed the taste of milk beverages. Often participants described milk as having a creamy taste.

> *"I like milk, I drink it all the time especially for breakfast…I grew up drinking milk and I know this is common practice in a lot of Ghanaian households…" (Participant No. 1, FGD 8)*

In terms of the health/nutritional benefits, participants reported milk as a good source of nutrients such as proteins and calcium. Consumers mentioned that they consumed milk beverages as one of the ways to help them maintain a balanced diet.

> *"I know milk is very nutritious…its rich in calcium, vitamin D and other vitamins and minerals and it is also a good source of protein" (Participant No. 9, FGD 5)*

Thus, consumers were knowledgeable on the benefits of milk in line with various researchers (Swati et al., 2016) who have reported milk as a good source of nutrients, including "nutrients of concern" such as calcium, Vitamin D, potassium, and Vitamin A which are often underconsumed by many populations. Regular consumption of milk/ milk beverages therefore helps in the maintenance of a balanced diet.

3.2. Perceptions of plant-based beverages

This aspect focused on consumers' knowledge of plant-based beverages, mode of consumption, reasons for consumption and barriers to the consumption of plant-based beverages (Fig. 3). Consumers defined plant-based beverages as milk obtained from plant sources. One consumer said:

> "*Plant based milk is milk that is gotten from a plant source, so like she said, you get soy milk from soya beans, there's coconut milk, almond milk, tiger nut milk, among others.*" (*Participant No. 6, FGD 1*)

Another consumer defined plant-based beverages as

> *"Um …ok for my understanding I think, plant based means the milk is from the extract of plants." (Participant No. 4, FGD 2)*

These definitions are in line with that of Swati et al. (2016) who defined plant milk as manufactured, non-dairy beverages made from water-based plant extracts with flavouring and aroma. Popular examples of plant-based beverages consumed by participants included soy milk, coconut milk, wheat milk, almond milk and tiger nut milk with soy milk being the most consumed. This is not surprising as soy milk has been reported to be the most common plant-based milk alternative (Vallath et al., 2022). Additionally, the popularity of soy milk among Ghanaian consumers could be attributed to the popularity of a locally manufactured soy-based beverage widely available on the Ghanaian market.

3.2.1. Facilitators of consumption of plant-based beverages

The main reasons identified for the consumption of plant-based beverages were health and nutrition (Fig. 3). This finding is in line with a recent study conducted in the United States which identified nutrition and health as the main drivers for the purchase of plant-based foods and beverages (Kerry Proprietary Research, 2020). In all demographic groups, consumers mentioned that they consumed plant-based beverages to achieve a healthy lifestyle and balanced diet. Consumers were also knowledgeable on some health benefits of plant-based beverages. They stated that plant-based beverages are lactose free, cholesterol free, have less fat compared to dairy milk and are also rich in vitamins and minerals. One participant said:

> "*I buy it mainly because the fat content is low compared to the animal-based milk*." (*Participant No. 7, FGD 4*).

Across the four groups, some participants inaccurately believed plant-based beverages to be nutritionally superior to cow's milk specifically in relation to protein and calcium. Plant-based beverages are generally lower in calories and protein as compared to cow's milk. Almond and soy milk for example provide about 0.55 and 2.78 g protein/100 g respectively compared to 3.27 g protein/100 g in cow's milk (USDA, 2023). Additionally, dairy milk is a naturally good source of calcium (123 mg/100 g). Plant-based beverages are typically fortified to enhance their nutritional profile to serve as a comparable cow's milk substitute (Haas et al., 2019). Plant-based beverages are however suitable options for consumers with allergies or lactose intolerances, consumers looking for lower calorie alternatives to cow's milk and consumers who practice alternative diets including vegan diets (Swati et al., 2016, McClements et al., 2020).

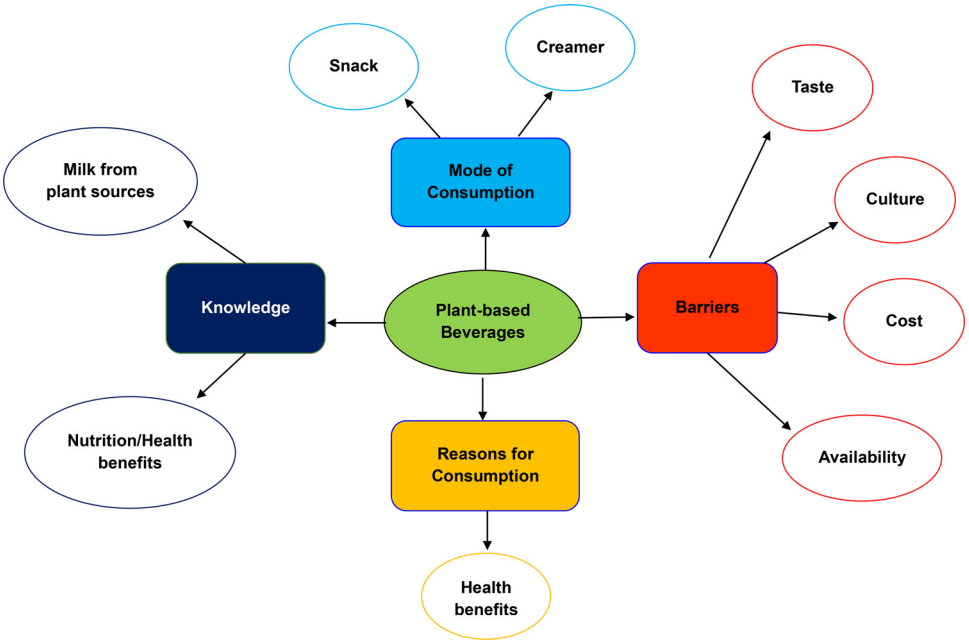

Fig. 3. Consumer perceptions of plant-based beverages. Illustrates a summary of the factors that influence consumer acceptability of plant-based beverages. The study focused on consumer knowledge of plant-based beverages, mode of consumption, reasons for consumption and barriers to the consumption of plant-based beverages.

"I *think plant-beverages are better than dairy milk, I know they are a good source of protein especially with soymilk…and they have less calories too…" (Participant No 11, FGD 6)*

"With all the noise on social media about plant milk, I am very sure it's because the new findings suggest that plant milk is healthier than animal milk." (Participant No. 8, FGD 3)

3.2.2. Barriers to the consumption of plant-based beverages

In all the groups, four main barriers to the consumption of plant-based beverages were identified. These were taste, culture, availability, and cost (Fig. 3). These factors are consistent with research findings of Skalkos & Kalyva (2023) and Januszewska et al. (2011). Additionally, McClements et al. (2020) found that although consumption of plant-based milk beverages is increasing, many consumers are reluctant to fully adopt plant-based beverages mainly because they find sensory properties such as taste, mouth feel and aroma to be undesirable compared to cow's milk. According to one participant:

"*I really don't enjoy the taste of plant-milk beverages like I do with the dairy milk beverages. For example, soy milk, even though I drink it, it doesn't taste as creamy as regular milk" (Participant No. 2, FGD 5*)

Participants also mentioned the high cost of plant-based beverages compared to dairy milk as a reason for lower consumption. This contradicts the observations of Settembre (2019) that plant-based beverages are driving consumer demand despite being more costly and more consumers in America were willing to pay nearly twice as much for plant-based milks. Most participants in this study reported that plant-based beverages were mostly available in high-end supermarkets thus accounting for their relatively high cost. As a result, participants stated that they were more likely to choose dairy milk products, which were comparatively more affordable and readily available. In relation to culture, cost, and availability, one participant said:

"*I haven't been exposed to different types. So far, I only know of soy milk, and I think I tried wheat milk recently. So, one of the factors is that I don't really know of other milk varieties. They are also quite expensive, so I don't drink it too often…." (Participant No. 7, FGD 2*)

Participants in the Mothers demographic segment mentioned allergies as a barrier to the consumption of plant-based beverages. Some mothers reported that their children suffered from allergies such as an itchy skin rash from the consumption of soy milk. According to Marcin (2018) symptoms of soy allergy includes itchy rash, tingling in the mouth, nausea among others.

3.2.3. Frequency of consumption

Among young adults, adults and middle-aged groups, participants generally reported that they did not consume plant milk beverages often. Frequencies reported included "*once a while*", "*not often*" and "*as and when*".

"Honestly, I don't drink plant-based beverages often…it's probably once a while when I feel like it or when I see it in a shop or something… (Participant No. 7, FGD 13)

Particularly in the Young adults and Adults groups, some participants reported that they had recently increased their consumption of plant-based beverage. These participants indicated that they consumed plant-based beverages at least twice weekly. In the Young Adults group, consumers reported that social media was a major influence on increasing their consumption of plant-based beverage as it was considered to be 'trendy'.

According to Moreira et al. (2021), social media marketing is more likely to influence the habits of young people, thus significantly improving the consumption behavior of young adult consumers and plant-based milk beverages. Specifically, the consumption behaviours of consumers in relation to plant-based beverages are influenced by a mix of social media advertisement, expert opinions and personal recommendations (Thompson et al., 2016).

"Now I definitely consume plant-based beverages more…probably like three times a week. I mean it's all over Instagram …and I know it's also good for you." (Participant No. 5, FGD 6)

Among the Adults demographic however, increased consumption of plant-based beverages was predicated on making healthier and environmentally conscious dietary decisions. As confirmed by McCarthy et al. (2015), the adoption of plant-based beverages is the result of both altruistic concerns (environmental concerns) and self-interest (food safety and health concerns).

"Nowadays, I drink my soymilk and almond milk at least twice a week…I'm trying to be more healthy and its good for the environment too" (Participant No. 3, FGD 4).

However, mothers reported a high frequency of plant-based beverages consumption for their children. Most mothers stated that they gave their kids plant-based beverages, mainly local brands of soymilk beverages, every day as snacks for school. This could be the result of a combination of factors, that is mothers choosing plant-based milk alternatives for their children as a result of growing interests in public health, trendy social media influences on plant-based beverage consumption coupled with making environmentally conscious decisions for their families.

One mother said:

"*I give my daughter Vitamilk as a snack for school every day, she really likes it". (Participant No. 5, FGD 4)*

3.2.4. Mode of consumption

Generally, participants reported a similar mode of consumption as for dairy milk beverages. Thus, the most popular mode of plant-based beverage consumption was as a snack, either alone or with biscuits or other pastries. Participants also reported that they used their plant-based beverages as creamers for their tea, porridge among others. A few consumers also stated that they used plant-based beverages for cooking including porridges, rice dishes and sauces. The limited use of plant-based beverages as a creamer was mostly attributed to the strong beany/nutty taste of some plant-based beverages as well as limited knowledge on the various ways plant milk could be consumed.

"I usually drink my soymilk with biscuits or alone when I need something to quickly refresh me…" (Participant No. 6, FGD 3)

3.3. Consumer sensory preferences

3.3.1. Form of plant-based beverage

Consumer preferences in relation to specific sensory/quality attributes were assessed. Most consumers across the different demographic groups indicated a preference for ready-to-drink/liquid milk beverages as opposed to powdered versions mainly because of convenience (Table 3). This confirms the findings of Aggarwal et al. (2003) that convenience is a key driving force in consumer food choices.

For packaging, the preferred choice among participants in the Adult, Middle Aged and Mothers groups was paper packaging. Consumer preference for paper packaging was influenced by safety concerns for the environment. Additionally, participants mentioned that paper packaged beverages were convenient and easy to use.

"*Considering the negative effects of plastic waste on our environment, I prefer paper packaging." (Participant No. 7, FGD 4)*

Participants in the Young Adults demographic group generally reported a preference for plastic packaged milk beverages (Table 3). The main perception of consumers in this group was that plastic packaged beverages were generally more affordable and convenient to use. Some participants also stated that they preferred plastic bottles because they could reuse/refill the containers. Regardless of packaging preference, consumers indicated that they preferred resealable packaging e.g., bottles or paper boxes with screw caps.

"*I like plastic bottles because I can reuse the container for something else…besides I think plastic packaged beverages are more affordable in my opinion…" (Participant No. 5, FGD 6)*

Table 3
Consumer preferred attributes of plant-based beverages.

Attributes	Demographic Groups	Preferences	Reasons
Packaging	Adults Middle-aged Mothers	Paper	• Environmentally friendly • Convenience
	Young Adults	Plastic	• Convenience • Cost
Form	All	Liquid	• Convenience
Flavour	Young Adults Adults Mothers	Sweetened & Flavoured	• Taste
	Middle aged	Unsweetened & Flavoured	• Taste • Health

3.3.2. Taste and flavour

In terms of taste preference, participants in the Young Adult, Adult and Mothers demographic groups generally reported that they preferred sweetened flavoured milk beverages with most participants referencing the sweetness of the popular local brand of soymilk as the preferred level of sweetness (Table 3). Popular flavours included banana, strawberry, chocolate, and vanilla.

"It has to be sweetened…if not I won't be able to drink it…Oh …and there should be some flavor as well like chocolate, vanilla, or something. The flavoured ones are my favourite… (Participant No. 1, FGD 7).

A few mothers however reported that their children suffered tummy upsets from drinking flavoured versions of plant-based beverages. Among the Middle-aged group however, participants generally reported that they preferred unsweetened, flavoured plant milk beverages mainly because of concerns about their age and related health issues.

3.4. Consumer perceptions and acceptability of new product concept

To determine consumer perceptions and acceptability of the new product concept, participants discussed their willingness to purchase the concept beverage and intent/expectation of purchase (Fig. 4).

3.4.1. Willingness to purchase concept beverage

The main drivers for consumers' willingness to purchase the concept beverage across all demographic groups were innovation of concept, taste, and nutrition. In terms of innovation of concept, some participants said:

"*Honestly, I've never even heard of a drink that combines tiger nut and cocoa. I didn't even know you could use the fruit for a drink…it sounds really interesting, and I would want to try…." (Participant No. 7, FGD 11)*

"This tiger nut and cocoa pulp drink, I've not seen some before…but I think it sounds interesting…I want to see how it would turn out…" (Participant No. 3, FGD 6)

Participants believed that the combination of tiger nut milk and cocoa pulp would result in a good tasting nutritious beverage. This assumption was made based on consumers' familiarity with both tiger nut and cocoa. Consumers mentioned that they consumed tiger nuts as a snack or in the form of tiger nut milk or tiger nut pudding. This is in line with the findings of Okyere & Odamtten (2014) and Suleiman et al. (2018) who reported that tiger nut is a popular crop that is widely consumed in Ghana, Nigeria and other parts of West and East Africa; it is mostly enjoyed fresh as a snack or in the form of a milky beverage known as tiger nut milk. Some participants stated:

"*I really enjoy eating tiger nuts. In fact, when it's in season, I eat it almost every day.…It is creamy and has a sweet taste…" (Participant No. 10, FGD 8)*

"Who doesn't know tiger nut in Ghana…Personally I like it especially when it's fresh. I enjoy eating it together with groundnuts and banana…" (Participant No. 6, FGD 5)

In all four groups, the main benefit of tiger nut milk that was reported was as an aphrodisiac, boosting male libido and fertility. Studies

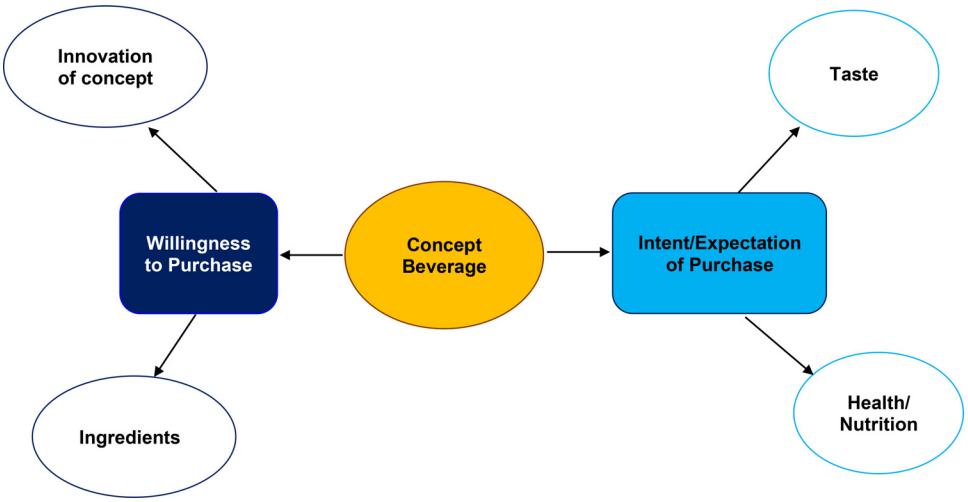

Fig. 4. Consumer perceptions of new product concept (Tiger nut milk & Cocoa pulp beverage). Illustrates the factors that influence consumer acceptability of the new product concept beverage (tiger nut milk & cocoa pulp beverage).

conducted by Olabiyi et al. (2016) suggest the potential ability of tiger nuts in promoting erectile function. Participants in the Mothers group indicated that regular consumption of tiger nuts promotes the production of breast milk. Additionally, tiger nuts were suggested to be a good source of nutrients and energy. Generally, consumers stated that they liked the taste of tiger nuts.

> "*As for tiger nuts, I know it's really popular among the guys…it makes us strong in the bedroom…" (Participant No. 1, FGD1)*

> *"…I know it's also good for breastfeeding mothers…I tried it when I was breastfeeding my daughter and it boosted my milk supply. It also worked for some of my friends too…" (Participant No. 3, FGD 8)*

Across the four demographic groups, consumers generally reported that they enjoyed the taste of cocoa. They described the taste of cocoa pulp as either sweet, sour or a combination of both. Some benefits of eating cocoa pulp reported by consumers were increased energy, improved mental performance, and improved digestion.

> "*I like cocoa…it has a different taste…it's a little sweet, sometimes a little sour…it's just difficult to describe but it tastes good." (Participant No. 7, FGD 3)*

> "*When we were kids, we enjoyed sucking the fruit off the cocoa seeds. It has a really nice tase and I know it gives you energy and helps with your digestion as well…" (Participant No. 4, FGD 9)*

3.4.2. Intent/Expectation of purchase

The two main factors identified were nutrition/health and taste. Participants reported that they would purchase the concept beverage mainly because they believed it would be a nutritious beverage with some health benefits including energy. Also, participants stated that they would opt for the concept beverage because of taste.

4. Conclusions

Generally, consumers were knowledgeable of plant-based beverages, with health and nutrition being the main drivers of consumption while, taste, cost, availability, and culture emerged as barriers to the consumption of plant-based beverages. Innovation of concept, taste and perceived health benefits of plant-based ingredients were the main drivers that influenced consumers' willingness to purchase the concept beverage. The findings of the study revealed key consumer insights indicating that tiger nut milk and cocoa pulp juice can be combined to develop an acceptable plant-based beverage for Ghanaian consumers.

Contributions of the study

Our study makes theoretical contributions to existing research. First, this paper contributes to literature on the consumption behaviours of consumers in relation to plant-based beverages. Additionally, it provides insights into factors that influence the desirability of plant-based beverages, offering perspectives specific to the Ghanaian consumer. The study can serve as a guide for marketing institutions and food product development companies that seek to successfully introduce new plant-based beverages to the African Market.

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Ethical statement

Participants in the consumer study were adults aged between 18–65 years and were recruited on a voluntary basis without any coercion. All participants were provided with the background information on the study and how the data collected would be used. No identifying information except age and sex were collected. All participants were free to withdraw from the study at any time.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Jacqueline Baaba Acquah: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. **Joris Gerald Niilante Amissah:** Conceptualization, Methodology, Supervision, Data curation, Writing – review & editing. **Nicole Sharon Affrifah:** Conceptualization, Methodology, Supervision, Data curation, Writing – review & editing. **Tim J Wooster:** Conceptualization, Methodology, Supervision, Data curation, Writing – review & editing. **Angelina Opoku Danquah:** Supervision, Writing – review & editing.

Data availability

Data will be made available on request.

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