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CONSUMER'S WILLINGNESS TO PAY FOR NOVEL HEALTHIER FOOD TO REDUCE MALNUTRITION IN AFRICA: A DISCRETE CHOICE EXPERIMENT APPROACH.

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ABSTRACT

In the recent decade, the rapid urbanization of African cities have been accompanied by nutritional transitions as a result of changes in lifestyle and dietary patterns. These changes greatly influence consumer's food preferences and purchasing decisions and, thus, potentially the development of obesity and other related non communicable diseases. In the rice sector, these changes have led to the consumption of highly processed products. However, the negative impact associated with the consumption of highly processed rice products of questionable safety and quality value is adding to the public health burden of non-communicable diseases. Thus, understanding consumer's food preferences to promote healthy food choices that meet populations' needs becomes essential to fight against the burden of malnutrition in Sub-Sahara Africa. This study aims to investigate the influence of information provision or treatments (positive frame and tasting) on consumer's willingness to pay for enhanced nutritious rice products (parboiled orylux 6 rice) in the urban city of Bouaké in Côte d'Ivoire. We use the real choice experiment approach in a three arm randomised control trial design to prompt consumer's preferences towards novel and healthier rice products in order to help people shift towards sustainable and healthier diets.

Keywords: real choice experiment, willingness to pay, healthy diets, rice Côte d'Ivoire

1. Introduction

Because of its wide local consumption, acceptability, reach, and quantum of consumption, rice (Oryza sativa) far exceeds the requirements of a staple food to fight against malnutrition and food insecurity at a population level (De-Regil et al., 2014). In Sub-Saharan Africa (SSA), rice is a fundamental for food security and social stability (Arouna et al., 2021). In Côte d'Ivoire, rice is considered as one of the main foodstuff with an average national consumption estimate at 63 kg/habitant/year 2008 (Arouna et al., 2023). This consumption is driven by the triple effect of population growth, urbanization and changing of consumer behaviour in the region. However, in many parts of Africa, consumers still perceive the quality of rice in their local markets to be poor (Ndindeng et al., 2021) and characterised by a high degree of foreign matter (stones, insects, weed seeds, etc.) (Demont, 2013) and records higher glycemic values (Arouna et al., 2023). Graham-Acquaah et al. (2020), Akoa Etoa *et al.* (2016) and Demont *et al.* (2012), reports that with the rapid urbanization of African cities, rice consumers, however, tends to become more sensitive to quality as their preferences have been shown to shift from lower to higher quality. Thus, implementing experimental surveys to assess consumer's food preferences in a rapid and changing context to promote a healthy and sustainable diet that meet populations' needs becomes essential to fight against the burden of malnutrition in Sub-Sahara Africa.

2. Methodology

The Discrete choice survey is an incentive-compatible method where consumers' trade-off between several options of the same product with different set of attributes at different levels of variation, and prices (Hensher et al., 2015). When the product is real, the willingness-to-pay (WTP) values obtained by DCE (Real Choice Survey) represent the best approximation of the true preferences expressed by consumers (De Magistris & Gracia, 2016). The study employs a three task arms (figure 1), to investigate the role of information communication formats (tasting and positive frame information) on consumer's preferences and willingness to pay for parboiled orylux 6 rice in Bouaké. Participants were randomly selected at the household and local market level (open vendors and supermarkets) based on the inclusion criteria below.

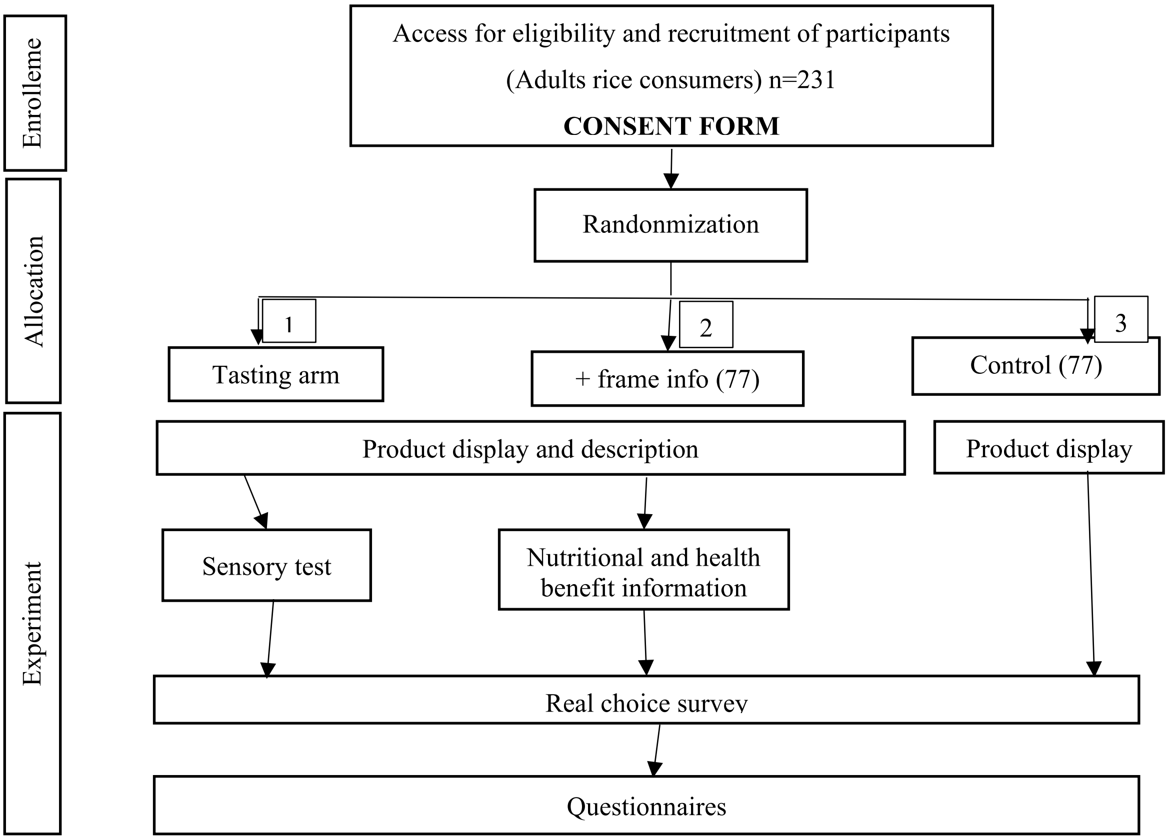
2.1. *Inclusion criteria*

Aged between 18 to 65. years old, be the primary food decision maker in the house, be able to speak or read French and/or English, or any local language spoken within the selected study area, must be living in the study area (Bouaké) or its surroundings, and must voluntarily be convenient to attend and stay in the study.

2.2. *Excluding criteria*

Participants with severe mental and physical disabilities, participants with specific diet excluding rice, participants who do not sign the consent form.

Figure 1: *randomised control trial design real choice experiment with parboiled rice*



2.3. Sample size

As indicated by Assele et al. (2023), sample size calculations for Discrete Choice Survey (DCE) studies have been approached in different ways. The most commonly used rule of thumb to determine the required sample size for a DCE was proposed by Orme (1998). The rule indicates that the number of respondents N should satisfy the inequality

$$\mathrm{N} \geq 500 \frac{L^{max}}{JS} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..3$$

where L^{max} is the largest number of levels for any of the attributes, J is the number of alternatives per choice task (not including the ''None''), and S is the number of choice sets each respondent receives. When considering all two-way interactions in the utility, $Lmax$ is equal to the largest product of the number of levels of any two attributes.

L^{max} = 4 (price attribute with four levels), J= two alternatives and S= 16 choice task to be responded by each participant, our sample size is thus as follow:

$$\mathrm{N} \geq 500 \frac{4}{2 * 16} = 62.5 = 63$$

Thus from the calculation above, a total of 231 participants were recruited (77 per treatment arm).

2.4. Survey procedure

Prior to attribute selection, an extensive literature review on determinants of rice consumption in Africa was conducted (Danso-Abbeam et al., 2014; Demont et Ndour 2015; Akoa Etoa et al., 2016; Coffie et al. 2023). Individual interviews with rice experts and workshop sessions with research partners from AfricaRice centre was equally organised. In the absence of an existing regulation on claims made on food in the African context and more precisely in Côte d'Ivoire, attributes were also selected based on the European regulation EC No 1924/2006 of the "European Parliament and of the council of 20 December 2006 on nutrition and health claims made on foods". Overall, four different attributes for parboiled orylux 6 rice were selected as shown in table below.

Table 6. *parboiled Orylux 6 rice attributes and levels*

Attributes	**Levels**	**Description**
Vitamins	1= High 0= Low	Water soluble vitamins that helps facilitates digestion
Nutritional claim	1= Yes 0= No	Nutritional benefit (ultra-low glycaemic index)
Health claim	1= Yes 0= No	Health benefit derived from consumption of parboiled orylux 6 rice rice (help regulate blood glucose level and weight)
Price	1= 500, 2= 1000, 3= 1500, 4= 2000	Price per Kg in Fcfa

The attributes and their levels were combined using the NGENE software to generate the choice set (Choice Metrics, 2018). A choice set of 16 choice tasks was generated using the D-Optimal design for both main and interaction effects (see equation 1 below). The optimality obtained for this survey is 97,21% D Optimality. In this survey, each choice task consisted of two alternatives (A and B) and an Opt-out (no buy) option. The first two alternatives (A and B) were generic alternatives of parboiled Orylux 6 rice varying with respect to attribute levels.

*U =B1*VITAMINS [0,1] + B2*NUTRI [0,1] + B3 * HEALTH [0,1] + B4 * PRICE [1,2,3,4] + B5*NUTRI*HEALTH ………………………………………1*

Where, *U* is the utility associated with alternatives. The coefficients *B1, B2, B3* and *B5.* are the weight (or parameter) associated with the attribute's vitamins, nutrition claim, health claim and the interaction between nutrition and health claim respectively. It indicates the contribution (direction of preference) of each attribute on the utility derived by a specific alternative. A positive coefficient indicates that consumers prefer the attribute, and a negative coefficient indicates otherwise.

*2.4. **Real choice experiment***

The real choice survey was conducted in two phases. The first phase relates to choice selection from alternatives presented within the choices tasks, and the second phase is the binding phase. Prior to the real choice experiment, participants were informed about the whole survey procedure. Attributes and their levels were equally explained to participants for better understanding. At the end of the first phase (choice selection phase for the 16 scenarios), one of the scenarios (among the 16 completed by the participant) was randomly selected as "binding". The respondent then had to buy the 1kg of parboiled orylux 6 rice that she or he indicated as most preferred for that selected scenario at the price indicated to ensure for income compatibility, unless for the Opt-out option. Each participant received a cash of 3000Fcfa. This amount was sufficient to ensure participants are not out of pocket as it was set above the highest alternative rice price in the survey.

Table 2. *intervention Tasks (treatments)*

Treatments	Description
Control	DCE questions
Tasting	Label info + sensory test + DCE questions
Positive frame	Label info + positive narrative information + DCE questions

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