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Strategy for European Consumer Acceptance of Traditional African Foods

This is a research project that seeks to explore ways that traditional African foods can be introduced to both African and EU markets. Within the EU, these products are currently not widely (or not at all) consumed. Most of these are unknown, apart from by the Diaspora. There are a number of reasons why these products are not widely consumed within the EU and these are related to food safety, sensorial acceptance and lack of marketing and promotion. The reengineering of the products will seek to overcome food safety and product quality issues to facilitate their promotion and introduction to EU markets.

This document is a resume of the strategy defined by the work team of ESB.UCP involved in the Consumer and Market Acceptance – WP5. The results of this package will be important not only for the European market strategy but also for the reengineering of these products.

The strategy includes three principle phases, which will be applied initially to products from Group 3, and then in February, based on this experience will be extended to Group 1 and 2, which are:

- 1) consumer acceptance in a view of market perception;
- 2) sensory characterization of in their traditional way of consumption in Africa
- 3) consumer acceptance of the point of view of sensory perception.

Following we will describe the SOP (Standard Operating Procedures) for each step.

SOP₁ – Standard Operating Procedures for consumer acceptance of the point of view of market perception. This task has two major activities which are (a) focus groups in the presence of the products (powder and drinks), to collect perceptions, first taste evaluation and main attributes that characterize those products. These results will be important to construct an appropriate (b) questionnaire and through a conjoint analysis methodology it will be make consumer segmentation. We pretend to compare the consumer segmentation between the involved countries (Portugal, France and England) and characterize a European consumer profile for these products. The results of this first stage will allow to make a segmentation of consumers for this products, which is an important information that can influence the next steps. At this stage this SOP₁ only includes information of part 1 (focus groups), once the part 2 (questionnaires) depends

on the part 1. It is expected that according the first results for product of Group 1, if the approach works efficiently, to be applied later in Group 2 and 3.

SOP₂ - Standard Operating Procedures for sensory characterization of *African products* in their traditional way of consumption in Africa. In this task it will be used a standard methodology for descriptive sensory analysis (identification and selection of a set of relevant descriptors giving maximum information on the sensory attributes of the product under analysis, in order to establish a sensory profile). The various stages in the methodology are mainly the training of the panel, preparation of a list of descriptive terms, reduction of the list of terms, choice of reference product for each attributes, training and finally use of the profile. At the end of this task it will be interesting to compare the results obtained by the three panels (ESB, CIRAD and NRI) involved in the sensory analysis. This comparison among three countries will be only performed to samples of group 3, since they have an extended shelf-life. The samples of remaining groups 1 and 2, will be tested only by one country as proposed in the project. The main applications for the sensory profile are as follows: to develop or change a product (reengineering); to define a product, production standard or trading standard in terms of its sensory attributes; to compare a product with a standard or with other similar products on the market or under development.

SOP₃ – Standard Operating Procedures for consumer acceptance of the point of view of sensory perception. This SOP includes two proofs: hedonic or affective tests and CATA (Check All That Apply) questions. The primary purpose of affective tests is to assess the personal response (preference and/or acceptance) by current or potential customers of a product, a product idea, or specific product characteristics. CATA questions consisted on valuable tools to understand consumer perception of the sensory and hedonic characteristics of the products. These methodologies could consist on useful and interesting complimentary techniques to trained assessors' data, being CATA question easier to understand and less time consuming for consumers.

It is planned the main activities for this work package, concerning the first group to be tested, Group 3, to be developed between November and February. However after verification of the concept of prove for this approach, it will be applied to group 1 and 2, starting if conditions are meet in the end of February. Schedule programed for each step will be conditioned to the samples received by Racines and Senegal partners, and will be updated accordingly.

Limitations and evaluation plan for Group1 and Group2

The products are Akpan, Kenkey, Gowe and Kishk sa'eedi (Group 1), Lanhouin, Kitoza and Kong (Group 2) and Adansonia digitata, Hibiscus sabdariffa and Ziziphus mauritana (group 3). The baseline study seeks to assess the acceptance of the products in their existing form but only if the products in the current form are safe to consume. These products are widely consumed within selected African countries but some may face issues when they require testing within the EU as they may not conform to EU regulations.

Group 1 (fermented cereals). These products are considered safe for testing within the EU although with Kishk, more information is required regarding the most suitable forms of the product for testing. Akpan, Gowe and Kenkey are currently available within the EU in small quantities either from specialised markets or can be especially prepared for this project. These products are difficult to obtain directly from African countries owing to their short shelf-life and the longer length of time needed to ship them to the EU. The shelf life may be improved following reengineering. In the case of Kishk, the longer shelf-life will enable the project to organise its shipping to the EU but IPR issues need to be addressed first to protect its commercial potential. The sensorial testing of Kishk will be finally decided during the project workshop meeting in Egypt in March 2012.

Group 2 (meat and fish products). These products are widely consumed within the selected countries in Africa but do not meet EU food safety requirements. Therefore, they are not actually suitable for testing by EU consumers. Different strategies are being considered depending on the products as follows:

Kitoza:

The meat product from Madagascar (including Kitoza) cannot currently be exported to the EU because this country undergoes an embargo on its meat due to FMD (authorities are currently negotiating with the EU for ways that meat products can conform to EU SPS requirements). Currently the only way to make known the kitoza to European consumers in Europe would be to produce it in Europe from European meat. This, however, is not possible at this stage of the project. It will be possible after the re-engineering phase. Sensorial testing for kitoza will be performed in February 2012 in

Madagascar with malagasy. In a second phase, with the results obtained on the re-engineered process, sensorial testing will be performed in Europe with European consumers using kitoza produced in Europe.

Kong :

Kong production from Senegal is not currently exported to the EU due to safety concerns (poly aromatic hydrocarbons - P.A.H). The existing process for producing the Kong in Senegal doesn't allow the final content of PAH to conform to EU SPS requirements. We therefore cannot perform sensory testing in Europe from Kong currently produced in Senegal. The project aim is that the new smoking process allows restarting the export of Senegal Kong. The project plans the first kong production in Europe in February 2012. For this Senegalese fresh fish will be imported into Europe and smoked in Europe. Sensorial testing will be performed with this product in Montpellier. We plan to transfer technology to Senegal. In a second phase sensory tests will be done in Europe with the Kong produced in Senegal.

Lanhouin:

It is foreseen to perform sensory testing in Benin both with African and European consumers in January 2012.

Assuming the previous limitations, the following table will be described the final decisions for consumer testing in EU:

Table showing groups, products, food safety and quality issues as well as decision for consumer testing in the EU.

Group	Product	Food Safety issues with baseline product	Quality issues with baseline product	Feasible to test baseline product in EU	Sensorial testing with EU Consumers in African countries*	Sensorial testing with EU consumers in EU countries
1	Akpan	None	Short shelf-life	Yes	Yes	France
	Kenkey	None	Short shelf life	Yes	Yes	UK
	Gowe	None	Short shelf-life	Yes	Yes	France
	Kishk	Currently being evaluated	-	-	Yes	Under evaluation

2	Lanhouin	Yes (no control over the fermentation)	Consistency	No	Yes	With re-engineered product
	Kitoza	Yes (Madagascar does not meet EU SPS requirements)*	Consistency	No	Yes	With re-engineered product
	Kong	Yes (PAH's)	Consistency	No	Yes	With re-engineered product
3	Adansonia digitata	None	Short-shelf-life (Juice only)	Yes	Yes	Portugal,
	Hibiscus sabdariffa	None	Short-shelf-life (Juice only)	Yes	Yes	Portugal, France & UK
	Ziziphus mauritana	None	None	Yes	Yes	France

* the possibility of manufacturing kitoza using the facilities at CIRAD was discussed but it was considered that it would be too difficult to precisely make the product within the EU for testing

Note: In the reengineered form, all of the products will be suitable for consumer testing within the EU

*The above sensorial testing will be further supported by testing these products with EU consumers who are currently either living or visiting each African country. This will enable the products to be directly compared with both African and EU consumers and can overcome the limitations in shelf-life of some of the products in their current form.

As described initially, the project is currently undertaking a cross-comparison study between EU consumers in Portugal, France and the UK for selected products only (Hibiscus and Adansonia). This will enable the research to explore variations in sensorial testing between different countries within the EU.

Products and amounts required for the first approach defined for group 3:

For the Consumer Tests (Focus Groups and Sensory Analysis) in Portugal it is required the next products and amounts (Table 1):

	Products	Amounts
<i>Baobab</i>	Infusion	5 boxes
	Powder	500 g
	Syrup Racine	12 Flashes of 75 cl
<i>Bissap</i>	Thé Granulado	7 flashes of 400 g
	Infusion	5 boxes
	Powder	500 g
	Cálix blanc Racine	500 g 5 bags
	Cálix Rouge Racine	500 g 5 bags
	Cultivar Red 1	5 bags with 500g
	Cultivar Red 2	5 bags with 500 g
	Syrup Racine	12 Bottles of 75 cl
	Syrup Senegal 1	7 L
	Syrup Senegal 2	7 L

It was also required the receipts for an appropriate preparation and the products for the Sensory Analysis in Europe and in Africa should be from the same lot.

SOP1: Procedures for the Focus Groups

1. Scope

The Focus Groups aims are gathering information on perceptions and attitudes of European consumers towards a new functional fruit juice with African origin: This methodology will be applied, in a first phase, only to Products from group 3, with extended shelf-life, and if results confirms effectiveness and advantages will be applied to products of Group 1 and 2. This is a qualitative study intending to probe and develop knowledge on the following issues:

- Most valued attributes of the product;
- Possible consumption situations and usage for this type of products;
- Willingness to pay for this novel products;
- Implications and influence that an African origin for a product might have on consumers perceptions.

This qualitative analysis will inform a survey questionnaire which follows as the next research step, which in turn is intended to give consumer segmentation criteria for the final sensory evaluation. This study contemplates the consumers' evaluation of the product in its typical form as it is consumed in their original African country. Part of these results will be used in the reengineering of these products for European tastes and preferences.

2. Moderator

The moderator should possess the necessary technical skills to effectively conduct the focus groups, and must promote empathy with the participants. It is fundamental the moderator's neutrality during the whole group discussion, keeping is role uniquely to conducting the discussion towards the topics of interest and to ensure a balanced participation of all the group's members.

3. Participants

It is expected to have 3 Focus Groups, each one with 8/10 participants, between 90-120 min, following the next criteria (Table 2):

Table 2 – Criteria for the recruitment of participants for the Focus Groups

	Focus Group 1	Focus Group 2	Focus Group 3
	18-25 years	26-55 years	+ 55 years
	Fruit juice Consumer		
Criteria	Responsible at least for some of food buying for home	Responsible at least for 50% of food buying for home	
	Gender: 50% female, 50% male		
	Education: 50% bachelor/master/doctorate; 50% up to secondary school		

4. Method

To achieve this project a Focus Group guide was constructed (Appendix 1), based on the information contained in the state of the art.

5. Procedure

The instrument for data collection is Focus Groups, using the script for the purpose mentioned above, and a video recorder. When the focus group is finished, an observation grid (Appendix 2) can be filled in order to register any additional information.

To register the permission to conduct the focus group and an authorization for video recording, participants should sign each a participant consent form and an information sheet (Appendix 3), ensuring confidentiality of information and voluntary participation.

The next step is the transcription of all conversation from focus groups. All data are analyzed by content analysis techniques to outline findings and meet research goals for this stage.

6. Language

The focus group guide should be available in the participants' native language; text and verbal instructions should unambiguous and simple to read and understand.

7. Facilities

The focus group should take place in a pleasant room, with a conference table and chairs for all people. A comfortable environment (temperature, light, ...) is important in order to promote relaxation of the participants. Distractions inside or outside the room, like noise or movement, should be minimized.

8. Limitations / Issues to be considered

Important points to consider when conducting the panel:

1. Try do eliminate language barriers, using simple language and avoiding technical jargon, rephrasing the answers to ensure clarity to all;
2. Ensure a qualified and well prepared;
3. The number of participants in the study does not allow the generalization of results

9. Text Consulted

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SOP2: Sensory Analysis of *African* products - Methodology - General Guidance For Establishing a Sensory Profile in EU Countries – document based on ISO 11035:1994.

1. Scope and Application

This document describes the overall process for developing a sensory profile. Sensory profiles can be established for products such as foods and beverages, and can also be useful in studies of human cognition and behaviour. Some applications of sensory profiling are as follows:

- to develop or change a product;
- to define a product, production standard or trading standard in terms of its sensory attributes;
- to study and improve shelf-life;
- to define a reference “fresh” product for shelf-life testing;
- to compare a product with a standard or with other similar products on the market or under development;
- to map a product's perceived attributes for the purpose of relating them to factors such as instrumental, chemical or physical properties, and/or to consumer acceptability;
- to characterize by type and intensity the off-odours or off-tastes in a sample of air or water (e.g. in pollution studies).

2. References

ISO 4121, Sensory analysis — Methodology — Evaluation of food products by methods using scales.

ISO 5492, Sensory analysis — Vocabulary.

ISO 5496, Sensory analysis — Methodology — Initiation and training of assessors in the detection and recognition of odours.

ISO 6564, Sensory analysis — Methodology — Flavour profile methods.

ISO 6658, Sensory analysis — Methodology — General guidance.

ISO 8586-1, Sensory analysis — General guidance for the selection, training and monitoring of assessors — Part 1: Selected assessors.

ISO 8586-2, Sensory analysis — General guidance for the selection, training and monitoring of assessors — Part 2: Experts.

ISO 8589, Sensory analysis — General guidance for the design of test rooms.

ISO 11035, Sensory analysis — Identification and selection of descriptors for establishing a sensory profile by a multidimensional approach.

ISO 11036, Sensory analysis — Methodology — Texture profile.

ISO 11056, Sensory analysis — Methodology — Magnitude estimation method.

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Piqueras-Fizman et al., 2011. Piqueras-Fizman, B., Ares, G., Alcaide-Marzal, J. and Diego-Más, J.A. Comparing older and younger users' perceptions of mobile phones and watches using CATA questions and preference mapping on the design characteristics. *J. Sensory Studies* 26, 1-12.

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3. Definitions

Sensory Profile: description of the sensory properties of a sample, comprising the sensory attributes in the order of perception, and with assignment of an intensity value for each attribute.

Note: This is a generic term for any type of profile, whether full or partial, trademarked or not.

Descriptor: a term referring the assessor to an element of the perception of the product. The properties of the descriptor (relevance of the product, monodimensional) shall be such that it can be used to produce an evaluation on a scale of intensity (sweet flavour of sucrose, for example).

Partial Sensory Profile: profile comprising certain selected attributes, with their intensity values.

Examples: Odour profile, flavour profile and texture profile.

Conventional Sensory Profile: profile obtained by statistical treatment of data issued from several assessors using a single list of attributes.

4. Principles

Identification and selection of a set of relevant descriptors giving maximum information on the sensory properties of the product under analysis, in order to establish a sensory profile.

The various stages in the methodology are given below (see Figure 2).

- selecting the panel;
- selecting products with a range of sensory properties;
- preparation of a list of descriptors;
- reduction of the list of descriptors;
- choice the limits of the scale for each descriptor;
- choice of reference products, when available;
- training the assessors;
- use of the profile;
- conduct the sensory tests;
- analyse the results.

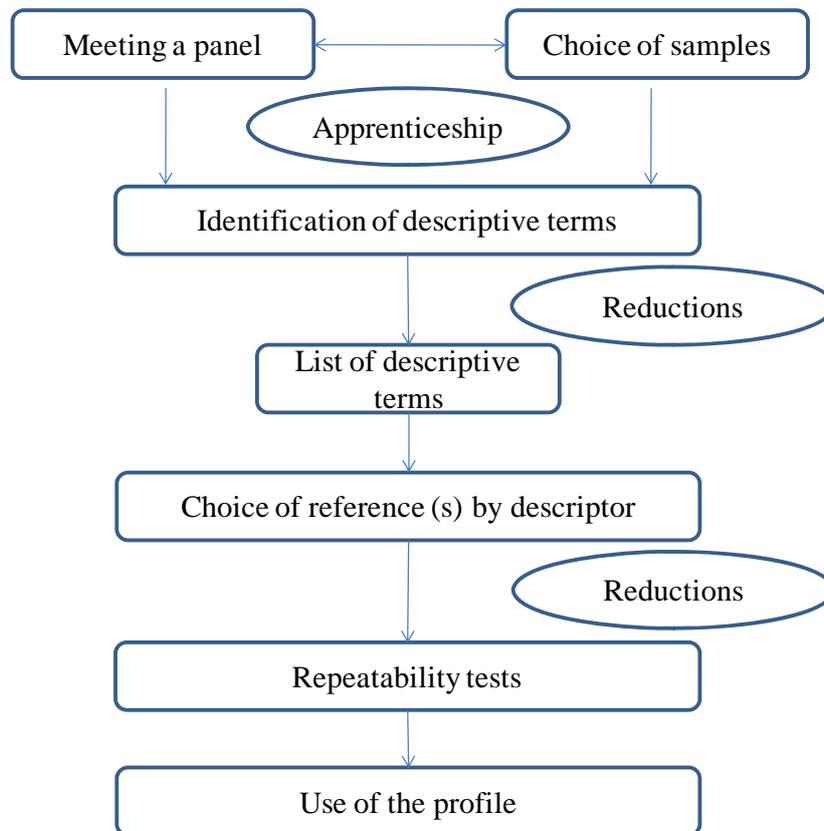


Figure 2 - Stages in the identification and selection of descriptors for establishing a sensory profile.

5. General Test Requirements

Test room

Carry out sensory profiling in booths (when available) under the conditions as described in ISO 8589. For the initial phases of the identification and selection of descriptors, arrange to have assessors seated around a central table, on which a variety of samples representing a range of sensory properties of the product may be available; see ISO 8589.

Apparatus

The apparatus should be selected by the panel leader according to the nature of the product or products to be analysed, the number of samples, etc., and shall have no influence on the results.

Select the number of samples and their mode of presentation so as not to bias the results in any way; see ISO 6658. In each sensory session, approximately 30-50 mL per beverage or 30-50 mg per product should be evaluated at the defined temperature.

6. Methodology

Number of assessors

A minimum number of ten assessors are required in order to allow for individual differences. In order to have a group of ten assessors permanently available, it is recommended that 12 to 20 assessors be trained and coached.

Selection and Training of the Panel

See ISO 8586-1 and ISO 8586-2 for descriptors of the selection, training and monitoring of assessors. However, these methods shall be adapted to the profile concerned (overall profile, flavour profile, texture profile, etc.). Ideally the assessors regularly attend sensory analysis training sessions but this may vary with demand. Recruit candidates through talks, circulars or personal contact. The important characteristics are the following:

- interest and motivation;
- ability to memorize and communicate sensory impressions;
- availability for panel sessions;
- capacity to concentrate and honesty in reporting sensations;
- promptness;
- good health;
- ability to discriminate the specific characteristics studied,
- engagement for the duration of the study.

When selecting the assessors, their creativity and their ability to express themselves are the first criteria to be taken into account. In fact, it is important for the assessors to have

an extensive vocabulary and to be at ease in the use of this vocabulary in order to produce a simple and easily understood description of the product to facilitate communication between the various parties concerned.

The quality of the sensory profile depends on the quality of the panel. It is important that the assessors are correctly trained and coached before selection according to their ability to recognize and evaluate the stimuli pertaining to the types of products for which a sensory profile is to be established.

Training is carried out on the types of products for which the profile is to be established or on their component parts (identification of the components and evaluation of the perceived intensities). Several preliminary sessions contribute to the training of the assessors. When this training period is over, the capacity of each assessor to repeat the evaluation shall be verified.

Role of Panel leader

The role of the Panel leader is of utmost importance in the selection of the assessors, their training and maintaining their motivation. The Panel leader should also be able to conduct and coordinate a work group, taking into account the opinions of each participant and harmonizing them.

Identification of the largest possible number of descriptors

The aim of this stage in the identification of descriptors is not to neglect any aspect of the product and to avoid bias due to the influence of an individual on the group. It also serves as an apprenticeship for identifying and evaluating the nature of the differences.

Selection of products

Selection of products will depend on availability. Ideally a series of similar products should be selected (5 to 10) which, when tasted, will enable the assessors to distinguish all the possible qualitative differences which can be detected in the product for which the profile is to be drawn up. To obtain these differences between products, factors such as varieties (raw material), harvest time, ageing, various processing technologies, proportions of ingredients during manufacture, or the duration of certain stages in manufacture or in preparation (duration of cooking, proportion of product/water ...) can be varied (when possible). Another possibility would be to examine similar rival products.

Generation of descriptors

In order for the assessors to achieve the necessary concentration for individual identification of the descriptive terms, without trying to make do with the terms given by others, the assessors should each be in tasting booths if available (see ISO 8589) under the usual conditions for sensory evaluation of products. In the initial sessions (at least two), the assessors are presented with the product for which the profile is to be made as well as the series of selected samples. The assessors are asked to generate individually the maximum number of terms (descriptors) to describe all the sensations

produced by these products, whether visual, tactile, olfactory or gustatory (in the case of an overall profile) and to note down on a blank sheet of A4 paper all the terms which occur to them.

Group discussion

The assessors then discuss in a group and compare their perceptions under the guidance of the panel leader who should encourage each of them to analyse the different components of the perception of the products. These components shall be expressed by an appropriate descriptor (e.g. bitterness, acidity, smoky flavour, etc.). The identification of terms ceases once the assessors have exhausted their vocabulary on the product. The group usually manages to generate without difficulty at least 50 different descriptors. All the descriptors are then collected together at this stage, including synonyms.

Preliminary sorting of descriptors

This sorting is performed during the initial sessions by the panel leader during group discussions and in the presence of the samples.

The following are gradually eliminated from the discussion:

- hedonistic terms, such as pleasant, fine, appetizing, good, etc.;
- quantitative terms, such as too much, too little, strong, weak, etc.;
- terms describing the product in its own terms, such as “breadly taste” for bread (except for certain cases of prepared or converted products where the odour or the aroma of a constituent remains, for example the aroma of vanillin or vanilla in vanilla ice cream);
- irrelevant terms such as “acid” when describing an odour.

The panel leader explains to the assessors why these terms are considered to be unsuitable for the intended purpose, which is to identify and describe the nature of the perception and the combinations of differences between products.

First reduction of the number of descriptors

The descriptors resulting from the preliminary sorting are generally too great in number; in further tasting sessions, terms are eliminated which do not appear suitable for describing or differentiating products from a sensory point of view. In order to make this reduction, it is necessary to make sure that the assessors have well understood the meaning of each descriptor and so re-tasting of the product by the assessors may be necessary and the assessor who suggested the term should describe it to the others to see if a consensus among the assessors can be reached.

The assessors are presented with the product and are asked, for each of the descriptors used, to judge the perceived intensity by allocating it a mark on a scale consisting of a horizontal 10 cm line with anchor points from 0 to 5, specifying that zero (0) is equivalent to an absence of perception for the property considered (it is possible to

check if there are differences or not in the perception of the products by using triangular tests). Consult ISO 4121 for methods using scales and categories.

In order to reduce at this stage the number of descriptors, the following procedure could be used, if applicable:

- Initially, classify by the geometric mean M , which is the Square root of the product of the frequency, F , and the relative intensity, I , of each descriptor:

$$M = \sqrt{F \times I}$$

Where: F is the number of times the descriptor is mentioned over the total number of times it is possible to mention that descriptor, expressed as a percentage; and

I is the sum of the intensities given by the whole panel for a descriptor over the maximum possible intensity for this descriptor, expressed as a percentage.

This method of calculation makes it possible to take into account, in the same way, descriptors which are rarely mentioned but which are very important in terms of the perceived intensity and descriptors with a low perceived intensity but which are mentioned often.

The classification of descriptors according to the size of this mean makes it possible to eliminate a number of descriptors whose geometrical means are relatively low.

Second reduction in the number of descriptors

The second reduction makes it possible to group together synonyms (correlated positively) or antonyms (correlated negatively) and eliminate descriptors which make very little contribution to showing differences between the products tested in a sensory profile.

Further reduction in the number of descriptors can be achieved by multidimensional analysis (see ISO 11035) or by consensus.

After at least three trial panels, Principal Component Analysis (PCA) allows evaluation of the relative importance and the contribution of descriptors in differentiating products since it allows all the products to be visualized at the same time as well as the correlations between the descriptors. By identifying the closeness of the descriptors and the weight attached to each descriptor for distinguishing between products, it is possible to eliminate some of them or to group them together.

The final number of descriptors should be at most 15 in order to obtain an operational profile that does not overwhelm the assessors and result in fatigue. If the number of descriptors is too high, what one hopes to gain in finesse is lost in the accuracy of the measurement.

Once the distinguishing descriptors have been selected, the next step is to choose an appropriate response scale by which to indicate the intensity of each descriptor present in a given sample.

The assessors are asked, for each of the descriptors used, to judge the perceived intensity by allocating it a mark on a scale consisting of a horizontal 10 cm line going from a minimum or an absence of perception to a maximum. Consult ISO 4121 for methods using scales and categories.

Choice of reference products or substances

A definition of each descriptor shall be given, understood by all the assessors, which shall be kept for easy reference. A suitable stable reference product shall also be assigned to each of these descriptors, where available.

A pure chemical is not necessarily a relevant reference substance for defining a descriptor. It is important to use reference products which are stable or reproducible in time. The choice of these reference products can be difficult, as it is a question of reconciling appropriateness and ease of use.

Training the Panel in the use of the reduced list

In order to train a panel correctly, at least one reference product (where available) shall be used per descriptor at a concentration corresponding to the mean position on the intensity scale.

A method which is surer but longer to set up is to offer also references for all the steps on the scale or at least for those representing the extremes. In this way it can be guaranteed that the assessors will be homogeneous with respect to one another and that they will analyse the intensity of the perception corresponding to this descriptor in the same way.

Training is satisfactory if each assessor repeats him/herself appropriately (i.e. if the standard deviation is slight for repetitions with the same samples).

Training is carried out on the types of products for which the profile is to be established or on their component parts (identification of the components and evaluation of the perceived intensities). Several preliminary sessions contribute to the training of the assessors. When this training period is over, the capacity of each assessor to repeat the evaluation shall be verified.

Conducting the sensory tests

Once the panel is well trained, i.e. when it has assimilated all the perceptions associated with the descriptors and is capable of quantifying the perceptions, it can serve as a measuring instrument and establish a profile. (See also ISO 6564).

In the test sessions, the assessors check the samples against the glossary of terms, scoring each attribute on an intensity scale.

Preparation and presentation of test samples

Standardize the preparation of samples and serve samples at uniform temperature. Code samples with three-digit random numbers. The order of presentation to the assessor must be also randomized. If the number of possible combinations becomes too large for full randomization, use an appropriate sampling plan.

Present the samples simultaneously, if possible, or in succession, one-by-one, if samples show differences in appearance that cannot be masked, or for instance if the texture of the product is not constant with time or temperature.

Evaluation of test samples

Use preprinted score sheets containing instructions regarding the scale to be used.

Arrange for assessors to work alone (in a booth if available). As a general rule, offer a maximum of four samples per session and per assessor for a full descriptive analysis with under ten to fifteen descriptors.

To increase the reliability and validity of results, present any sample or sample group two or three times if possible on different days. Replication is necessary to provide an estimate of experimental error. Note that the effect of repeating the same sample is to show the dispersion of scores among assessors. Watch for assessor x product interaction (assessors evaluate the products differently).

7. Analysis and Interpretation of Results - Establishing Profiles

After the assessors have completed their assessments, the panel leader tabulates the results and initiates a discussion to resolve differences. In the light of the discussion and, if necessary, after re-examination of the samples, the panel arrives at a group decision on the profile.

A profile is obtained from the average of the scores assigned by each assessor.

There is no simple way of treating the results statistically. Analysis of variance has been used to determine consensus among the assessors for each single attribute. Multivariate techniques of analysis (Principal Components Analysis) have been used to explore the meaning and significance of differences between products and assessors. Multiple stepwise linear regressions have been used to model sensory and instrumental methods.

The graphical representation of a sensory profile can be used to visualize the characteristics of the product. A bar graph or histogram or any other form can be used which is easy to read and provides a comparison between the various products.

The graphs can provide the following information:

- standard deviations or confidence intervals for each descriptor;
- result by assessor;
- comparative position of all the products evaluated;
- deviations with respect to a standard product profile used as a reference.

Examples:

Examples of questionnaires and detailed information for specific product of group 1, 2 and 3 can be found in **Deliverable number: D5.3.2.** - Procedures for sensory evaluation and consumer preference studies involving the African consumer.

SOP3: Hedonic Measurements and Check-All-That-Apply (CATA) Questions

1. Scope and Application

The primary purpose of affective/hedonic tests is to assess the personal response (preference and/or acceptance) by current or potential customers of a product, a product idea, or specific product characteristics.

The most effective tests for preference or acceptance are based on carefully designed test protocols run among carefully selected subjects with representative products. The choice of test protocol and subjects is based on the project perspective which fall into one of the following categories:

- Product maintenance;
- Product improvement/optimization;
- Development of new products;
- Assessment of market potential;
- Product category review;
- Support for advertising claims.

Sensory profiling is a powerful tool for the food industry, traditionally this methodology has been performed with a group of trained assessors who objectively provide a quantitative description of the sensory characteristics of food products (Meilgaard et al., 1999; Stone and Siedel, 1985).

Consumers have been considered only capable of hedonic judgement. However, in order to design food products that meet consumer sensory expectations, food companies need information about how consumers perceive the sensory characteristics of the product (Parente et al., 2011).

Traditionally, to understand the relationship between consumer and sensory data, preference mapping is a useful method. Preference mapping is a widely used group of multivariate statistical techniques designed to optimize products by understanding the structure between consumer preference and sensory data to identify drivers of liking (Greenhoff and MacFie, 1999; Piqueras-Fizman et al., 2011; Parente et al., 2011).

Check-all-that-apply (CATA) questions regarding consumer-perceived product attributes have been used in consumer studies to determine what sensory attributes may be characteristic of a specific product (Lancaster & Foley, 2007). The use of a CATA question resulted in a simple and valid approach to gather information about consumers' perception of the product, including both their sensory and hedonic impression. This methodology enabled the direct identification of drivers of liking for groups of consumers with different preference patterns (Ares et al., 2010^a; Ares et al., 2010^b; Parente et al., 2011).

The actual generation of CATA terms can be performed in many ways: the consumers can choose words to describe the product during the test (modified free choice profiling), terms can be given by a trained panel (i.e. a quantitative descriptive analysis –QDA), or terms can be generated by consumers not testing the product (i.e. a focus group) (Dooley et al., 2010; Ares et al., 2010^b).

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3. Definitions and Principles

Sensory evaluation: is the application of scientific principles to the measurement, analysis, and the interpretation of the reaction of assessors to those inherent characteristics of materials as they are perceived by our senses of sight, smell, sound, taste and touch;

Sensory quality (sensory properties, organoleptic properties): is based on product characteristics/properties as they are perceived by our senses of sight, smell, sound, taste and touch;

Hedonic quality: is the affective evaluation by consumers of a product and its sensory properties.

As illustrated in Figure 3, the sensory input function comprises the first stage of processing, which includes sensory transduction of the stimulus via receptor processes and encoding to an internal representation, including sensation quality, intensity and hedonic values. There is considerable evidence that the input function is strongly influenced by, among other things, the sensory perceptual context. The output stage includes evaluative and decisional processes involved in making a decision as to the appropriate response and producing that response.

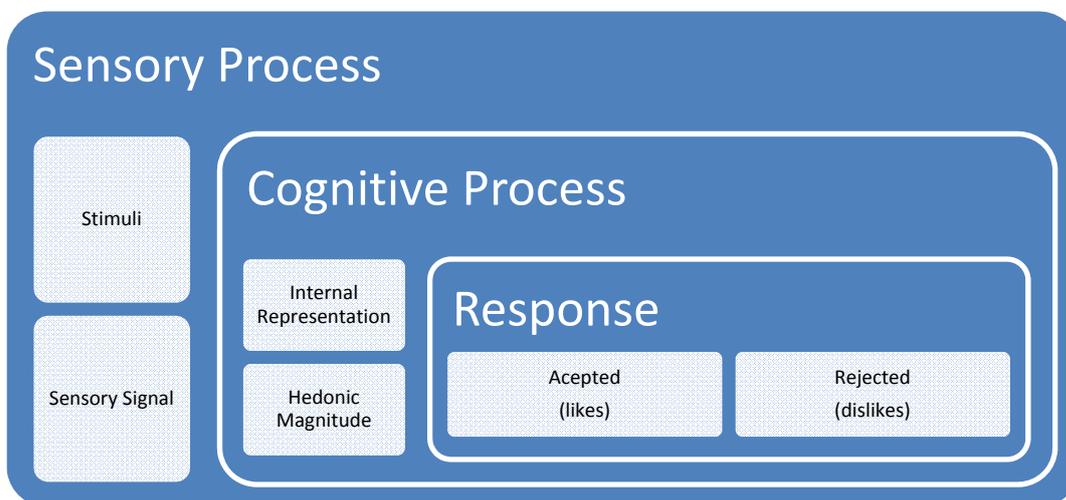


Figure 3 - A simple illustration of stimulus-response model (adapted on Lim, 2011).

A check-all-that-apply (CATA) questions consists of a list of words or phrases from which respondents should select all the words they consider appropriate to describe a product. This type of methodology has the advantage of gathering information on perceived product attributes without requiring scaling, allowing for a slightly less contrived description of the main sensory properties of the product tested (Dooley et al., 2010).

The use of a CATA question resulted in a simple and valid approach to gather information about consumers' perception of the product, including both their sensory and hedonic impression.

4. General Test Requirements

Affective/hedonic tests are divided into two methods:

AFFECTIVE METHODS: QUALITATIVE

Qualitative affective tests are those (e.g., interviews and focus groups) which measure subjective responses of a sample of consumers to the sensory properties of products by having those consumers talk about their feelings in an interview or small group setting.

Qualitative methods are used in the following situations:

- To uncover and understand consumer needs that are unexpressed ;
- To assess consumers initial responses to a product concept and/or a product prototype;
- To learn consumer terminology to describe the sensory attributes of a concept, prototype or commercial product, or product category ;
- To learn about consumer behavior regarding use of a particular product.

In the qualitative methods discussed below, a highly trained interviewer/ moderator is required. Because of the high level of interaction between the interviewer/ moderator and the consumers, the interviewer must learn group dynamic skills, probing techniques for appearing neutral, and summarizing and reporting skills.

Affective/Hedonic (degree of liking) tests are consumer-oriented tests. These tests are considered to be consumer tests since they should be conducted using untrained consumer panels.

Types of Qualitative Affective Tests:

- Focus Groups
- Focus Panels
- One-on-One Interviews

AFFECTIVE METHODS: QUANTITATIVE

Quantitative affective tests are those which determine the responses of a large group (50 to several hundred) of consumers to a set of questions regarding preference, liking, sensory attributes, etc.

Quantitative affective are applied in the following situations:

- To determine overall *preference or liking* for a product or products by a sample of consumers who represent the population for whom the product is intended. Decisions about whether to use acceptance and/ or preference questions are discussed under each test method below;
- To determine preference or *liking for broad aspects* of product sensory properties (aroma, flavor, appearance, texture). Studying broad facets of product character can provide insight regarding the factors affecting overall preference or liking;
- To measure *consumer responses to specific sensory attributes* of a product. Use of intensity, hedonic, or "just right" scales can generate data which can then be relates to hedonic rating discussed previously and to descriptive analysis data.

Types of quantitative affective tests

Affective tests can be classified into two main categories on the basis of the primary task of the test (Table 3):

Task	Test and type	Questions
Choice	Preference tests	Which sample do you prefer? Which sample do you like better?
Rating	Acceptance tests	How much do you like the product? How acceptable is the product?

In addition to these questions, which can be asked in several ways using various questionnaire forms (see as follows), the test design often asks secondary questions about the reasons for the expressed preference or acceptance.

Preference tests

The choice of preference or acceptance for a given affective test should be based again on the project objective. If the project is specifically designed to pit one product *directly* against another in situations such as *product improvement or parity with competition*, then a preference test is indicated. The preference test forces a choice of one item over another or others. What it does not do is indicate whether any of the products are liked or disliked. Therefore, the researcher must have prior knowledge of the "affective status" of the current product or competitive product, against which he or she is testing. Preference tests can be classified as follows (Table 4):

Test type	No. of samples	Preference
Paired preference	2	A choice of one sample over another (A-B)
Rank preference	3 or more	A relative order of preference of samples (A-B-C-D)
Multiple paired preference (all pairs)	3 or more	A series of paired samples with all samples paired with all others (A-B, A-C, A-D, B-C, B-D, C-D)
Multiple paired preference (selected pairs)	3 or more	A series of paired samples with one or two select samples (e.g., control) paired with two or more others (not paired with each other) (A-C, A-D, A-E, B-C, B-D, B-E)

Acceptance tests

When a product researcher needs to determinate the "affective status" of a product, i.e., how well it is liked by consumers, an acceptance test is the correct choice. The product is compared to a well-liked company product or that of a competitor, and a hedonic scale, is used to indicate degrees of unacceptable to acceptable, or dislike to like.

5. Methodology

Test room

Carry out sensory evaluation - hedonic measurements in booths (when available) under the conditions as described in ISO 8589.

Apparatus

Select the number of samples and their mode of presentation so as not to bias the results in any way; see ISO 6658. In each sensory session, approximately 50 mL per juice (minimum of 16 mL) should be evaluated at temperatures between 4 and 10 °C.

The 9-point hedonic scale is a balanced bipolar scale around neutral at the center with four positive and four negative categories on each side. The categories are labeled with phrases representing various degrees of affect and those labels are arranged successively to suggest a single continuum of likes and dislikes (Peryam & Pilgrim, 1957). As illustrated in Figure 2 the original form of the hedonic scale, that has been used since its development.

For each sample, consumers will be score their overall liking using a nine-point hedonic scale (1 = “dislike extremely”, 9 = “like extremely”) (Figura 4). Consumers will be asked to evaluate overall liking, appearance and flavor of the test-product.

First Hedonic Test: In the first hedonic test will not be reported about the products.

Second Hedonic Test: The interview will be conducted with the consumers, when it be given information about the origin and use of the products benefits, then there will be the second hedonic test.

Overall, how much do you like or dislike this juice sample?

Sample 351

<input type="checkbox"/>	Like extremely
<input type="checkbox"/>	Like very much
<input type="checkbox"/>	Like moderately
<input type="checkbox"/>	Like slightly
<input type="checkbox"/>	Neither like nor dislike
<input type="checkbox"/>	Dislike slightly
<input type="checkbox"/>	Dislike moderately
<input type="checkbox"/>	Dislike very much
<input type="checkbox"/>	Dislike extremely

Figure 4 - The 9-point hedonic scale (9.Like extremely / 1.Dislike extremely) by Peryam & Girardot (1952).

6. CATA Question

For each sample, consumers will be to answer a CATA question with hedonic impression and sensory attributes that will take in order to describe the samples (Dooley et al., 2010; Ares et al., 2010^b).

For each sample, consumers will be to answer a CATA question with hedonic impression and sensory attributes that they consider appropriate to describe the sample.

The words of CATA question will be select based on previous results from QDA and a previous focus group to describe the sample (Dooley et al., 2010; Ares et al., 2010^b).

For the CATA study, frequencies of mention for each word will be determined by counting the number of consumers that used that word to describe the sample, a minimum of 10% will be required.

The Figure 5 shows the steps of the sensory tests. The first stage of trained assessors' panel, followed by two stages of consumer study.

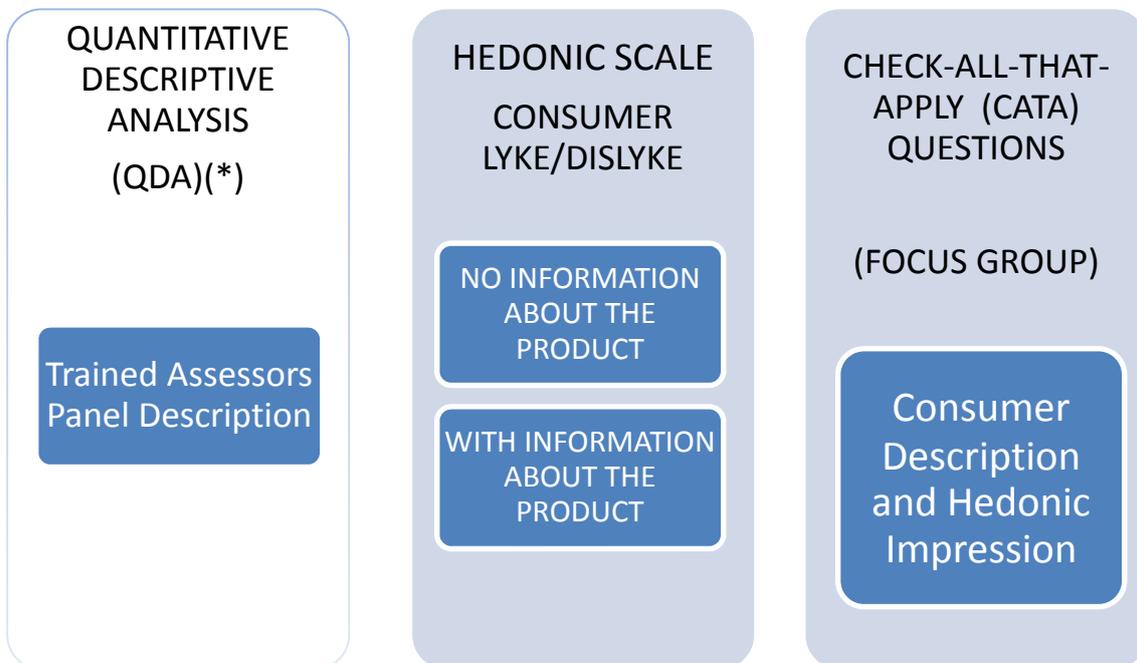
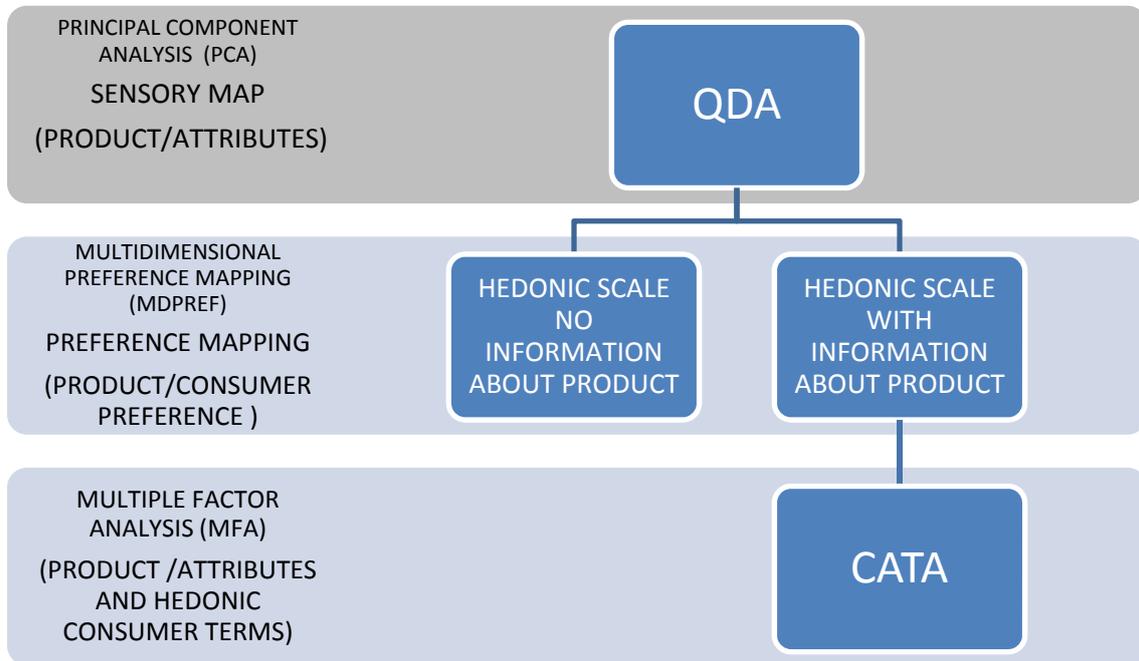


Figure 5 - Stages of sensory tests.

(*)Minimum of three samples

7. Statistical Analysis

The Figure 6 presents the statistical analysis will be performed to obtain the sensory map, preference mapping and CATA results.



QDA: Quantitative descriptive analysis ; CATA: check-all-that-apply

Figure 6 - Statistical analysis of the sensory results.

Appendix 1

FOCCUS GROUP GUIDE

“Perceptions and Attitudes of a new fruit juice with functional characteristics and African origin in European Countries”

BACKGROUND INFORMATION	
Name of the Investigator	
Focus Group number	
Date of the Focus Group	
Local of the Focus Group	
Country
City
Language used during the interview	

Phase 1 – Introduction | Time 15 minutes

Presentation of the moderator;

Thank to the participants and explain what they have in common and why they have been chosen;

Reading and signature of the participant of consent form;

Presentation of some rules for good development (only talk one person each time, there is no wrong answers)

Explain the methodology of the work and the importance to be audio and video recorded;

Presentation of each participant: name and ask what they think about this kind of studies;

Make presentation of the Baobab and Bissap fruit juice, and remember the objectives of the project. Present clearly to all the definition of functional food, giving examples and ensuring that all understand the same.

Phase 2 – General questions about Fruit juice | Time 20 minutes

- What comes to your mind when you think of drinking fruit juice?
- When do you usually drink fruit juices?
- Why do you drink fruit juices ?
- Why do you buy fruit juices ?
- In your opinion, what might make you buy a fruit juice brand completely new (for you)? What might make you not buy?

Phase 3 – Blind Taste Evaluation | Time 30 minutes

(give to the participants the glasses of juice (7 samples – 3 Baobab + 4 Bissap) and a glass of water to taste and make an sensory evaluation)

- Explain that Baobab fruit is a very nutritious drink because is rich on vitamin C (double than milk), and others (A and B1, B2 and B6), and also has antioxidant properties. Bissap is also a very nutritious fruit specially because the high content of antioxidant (anthocyanin).
- What do you think about the juices? Which is your general perception ? Did you like any of them? Why did you like it? Why did you not like it? Which one is for you the best and the worst?
- How do you characterize each?
- Can you imagine yourself buying any of these juices? Which ones? (write all the “yes” answers in the board, visible for all)
- Why would you buy? In what consumption situation (just assume they are easily available on the cafe, restaurant or supermarkets nearest to you)? For what purpose would you buy? (ask for every fruit juice with at least an “yes” answer)
- Which ones would you not buy? (list in the board, visible for all) Why would you not buy (ask for every fruit juice with at least a “no” answer)?
- Out of all fruit juices you know on sale in the supermarkets you visit and that you normally buy, do you think some are similar to any of these new ones? Do you think any of these new ones might be a good substitute to any of the ones you are already familiar? Which ones? (form pairs in the board, visible to all)
- For the ones you would buy, imagine that they have a convenient and attractive packaging, what would be the maximum price you would be willing to pay for a 1 L package, in a supermarket for example?
- If you were looking for it, in what sort of shops or Pont of sales would you expect to find these sort of juices?
- Where do you think these fruit Juices were produced? Do you think this is an important information for you?
- These fruit juice have are all of Africa origin, do you think this fact will have any influence on what you think of each? Would this change anything you said before about any of these juices?

Phase 4 – Raw product acceptability | Time 10 minutes

- Show raw product and tell how to prepare for each of the 7 sample
- Would this new information change anything you said before about any of these juices?

Phase 5 – Summary and synthesis | Time 10 minutes

- Brain storming about the characteristics mentioned for all before
- Ask for any suggestion for the next Focus Groups.

Phase 6 – Final | Time 5 minutes

- Finishing and thank to the participation;
- Give the gifts to the participants

Appendix 2

OBSERVATIONS – in the end of the focus group, please register in this field any aspects that seems to be relevant to the content analysis of the interviews latter on.

Date: _____ / _____ / _____

(Signature of Moderator)

Appendix 3
PARTICIPANT CONSENT FORM

Title of Research:	
Investigator's name:	
To be completed by the participant	
1. Have you read the information sheet about this study?	YES / NO
2. If you asked questions did you receive satisfactory answers?	YES / NO / Not applicable
3. Do you understand that you are free to withdraw from this study at any time and without the need to give a reason?:	YES / NO
4. Do you give your agreement for the record of the Focus Group?	YES / NO
5. Do you agree to take part in this study?	YES / NO
Signed	Date
Participant name in block letters	
Signature of investigator	Date

This Project is Supervised by:
Contact Details (including telephone number):

Direct line :
e-mail :

Fax:
Date:

Information Sheet

We are undertaking a study to compare the acceptability of xxx product. This research has been funded by the European Union (African Food Tradition Revisited by Research, KBBE-2009-2-3-02, Sharing food technology research and development through international collaboration – SICA).

The results from your participation will help advise the project about a fruit juice. During your participation at this focus group we will invite you to give your views about the product and taste samples. . You will be asked to complete and sign a consent form.

You can ask the researcher questions at any time. The products are ones that are traditionally consumed elsewhere and have produced according to good hygiene standards. They do not contain GMOs (genetically modified organisms). These products may contain xxxx which some people are allergic to. Also, xxx may have been an ingredient. Your participation is expected to last for no more than 90 minutes.

While we hope you will participate you are under no obligation to. If you choose to participate you are free to withdraw at any time and do not need to give a reason.

Thank you for your time.

Kind regards

SIGNATURE

NAME