

Research Application Summary

Traditional use of moringa leaves and baobab pulp as fortificant in mother and children feeding in Benin

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Abstract

The present paper summarizes preliminary results on the extent to which baobab fruit pulp and moringa leaf powder can be used in food to food fortification to alleviate micronutrients deficiencies among vulnerable groups in Benin. The work is being done through a Graduate Research Grant (GRG) financed by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). The project studied bioavailability of nutrients in food including moringa and baobab powders, and recommends how to improve food to food fortification formula for women and children under five. The effect of the developed product on the nutritional status of the target groups will be measured. In this paper, the preliminary results on documentation and traditional use and consumption patterns of foods fortified with baobab pulp and moringa leaves in the three biogeographical zones of Benin is reported. Field surveys were undertaken among mothers and resource persons in the target area. Structured questionnaires were used to collect data on the traditional food fortified with the food fortificants under investigation, their use in children and mother feeding and their consumption patterns. Results allowed grouping the food vehicles in four categories: porridges of cereals, porridges of legumes, vegetable sauces and non vegetable sauce. The use in mother and baby feeding of porridges of cereals fortified with Baobab pulp or moringa leaf powder as well as the use of vegetable sauce of moringa vary significantly from one biogeographical zones to another ($p < 0.001$). In contrast, the use of moringa as fortificant in non legume sauce was similar in the three zones ranging from 30-40% of informants (Chi-Sq = 0.393, P-Value = 0.822). The food use patterns of moringa and baobab varied from one zone to another, across target groups surveyed and by type of fortificant.

Key words: Benin, baobab pulp fruit, food to food fortification formula, in-vitro digestibility, moringa leaf powder

Résumé

Le présent document résume les résultats d'un travail visant à déterminer le niveau optimal d'utilisation de la pulpe de baobab et la poudre de feuilles de moringa pourraient

comme fortifiants pour réduire les problèmes de malnutrition carentielle au sein des groupes vulnérables au Bénin. Le travail en cours de réalisation dans le cadre du « Graduate Research Grant » financé par le RUFORUM. Le projet se focalisera sur la digestibilité *in vitro* des micronutriments dans les véhicules alimentaires utilisant la pulpe de baobab et la poudre de feuille de moringa comme fortifiants, en vue de proposer des formules adéquates pour les femmes et les enfants de moins de 5 ans. L'effet de ces formules sur la santé nutritionnelle des enfants et des femmes sera étudié. La présente étude présente les résultats de la documentation sur les utilisations traditionnelles et la consommation des aliments fortifiés avec la pulpe de baobab et les feuilles de Moringa dans l'alimentation des mères et des enfants dans les 3 zones biogéographiques du Bénin. Une enquête de terrain a été réalisée auprès des mères et personnes ressources. Des entretiens structures et semi structures ont permis de collecter les données sur les véhicules alimentaires traditionnellement fortifiés avec les fortifiants sus-cités, leur utilisation dans l'alimentation des mères et des enfants et leur consommation par ces derniers. Les résultats ont permis de grouper les groupes de véhicules alimentaires en 4 catégories : bouillies de céréales, bouillies de légumineuses, sauce légume et sauce non légume. L'utilisation des bouillies de céréales fortifiées avec la pulpe de baobab ou la poudre de feuille de moringa dans l'alimentation des mères varie de façon significative d'une zone biogéographique à une autre ($p < 0.01$). A l'opposé, l'utilisation du moringa comme sauce feuille est similaires dans les 3 zones biogéographiques et est pratiqué par 30 à 40% des enquêtés (Chi-Sq = 0.393, P-Value = 0.822).

Mots clefs: pulpe de baobab, poudre de feuille de moringa, formule de fortification, digestibilité-*in vitro*.

Background

Millions of women and children under age of five years die every year from malnutrition in Low- and Middle-Income Countries (LMICs) (IFPRI, 2014). Food insecurity and diseases related to undernutrition add a burden on already scarce health-care resources. To date, large numbers of rural families in sub-Saharan Africa are facing chronic food insecurity and cannot recover even in a good growing season. For example Benin Republic is facing many challenges, the most important ones being how to ensure food production and food and nutrition security for its 10 million people. In Benin, 37% of children aged from 6 to 59 months have chronic malnutrition of which 12% suffer from severe stunting. Chronic malnutrition is high in households with low income due to inadequate food consumption and hence food insecurity, as determined by availability, access, utilization of food and the stability of these three parameters (AGVSA, 2014). In addition, micronutrient deficiencies constitute major threats to maternal and child well-being. Thus improvement in food and nutrition security remains critical to achieve the well being of Benin nationals. Important sources of household nutrition in West Africa includes forest food resources which are proven to have high content of nutrients compared to daily needs and are already integrated to the diet of local

populations. Among others, baobab fruit pulp and moringa powders may be promoted because of their nutritional value (Chadare *et al.*, 2009; Houndji, 2013). Baobab and moringa have been selected among the ten top species that would merit more attention for food security in Africa (IPGRI, 2002). Several years later (FAO, 2014) confirmed the same 10 species as priority species to be valorized. In fact, baobab and moringa are ingrained in the cultures of local African communities. While baobab fruit pulp is consumed dry in nature, moringa can be consumed fresh but is mostly processed into powder by populations for preservation purpose. Moringa powder is also commonly commercially available. Consequently, improved quality of their products will be easily accepted. They are also among the so-called zero cost or very limited cost species since they do not need too much care and investment to grow. In areas with high rates of micronutrient deficiency and high levels of poverty, the use of fortification formula from chemical origin is difficult and rare. The adequate utilization of indigenous resources such as baobab and moringa can provide a means for local communities to improve their livelihood. The present project, which forms the basis for the study, aims to increase availability of food to food formulation including Baobab fruit pulp and moringa leaf powder for improving nutritional status of vulnerable groups.

This paper present preliminary result of the study to map local food matrices that are the most suitable for food to food fortification with baobab and moringa. The study will inform future work on building per biogeographical zone two food fortification formula for women of reproductive age and two for children aged from 6 to 59 months, according to their respective nutritional needs and bioavailability of key elements and, testing the effect of the food fortification formulas on the nutritional status of the target groups.

Study area

The field survey was carried out in the Republic of Benin, located between 6° and 12°50' N and 1° and 3°40' E in West Africa. All three biogeographical zones (Sudanian, Sudano-Guinean and Guineo-Congolian zones) embodying various ethnic groups characterized by their culture and food habits, were covered. The mapping of food vehicles was done through literature review complemented by a field survey.

Literature review

A literature search was undertaken from various sources including the internet, libraries and previous research on food habits from the three biogeographical zones of Benin.

Survey: (i) Sampling: Two municipalities were selected per biogeographical zones. In each of the municipality, a random check was done with 50 women to check for the proportion of women that use baobab pulp and/or moringa in children or mother feeding. The proportion p that consume was used to compute the minimum number N of informants (women of reproductive age) that should be interviewed in that municipality using the formula of Dagnellie (1998). $N = \frac{4P(n-P)}{d^2}$; d is the margin error fixed at 0,07.

(ii) Data collection: A survey was performed among women of reproductive age and resources persons. Focus group discussion (10 in total were conducted with 6-10 women), structured questionnaires (196 with mothers of children aged 6-59 months, 283 women of reproductive age and 41 resources persons) were used to collect data on various aspects related to the food that are traditionally fortified with baobab pulp and moringa leaf powder in the three biogeographical zones of Benin.

(iii) Data processing: Data from literature and the one from the survey were merged and used to identify staple foods that are traditionally fortified with baobab pulp and/or moringa leaves. Concerning data collected from the survey, a negative binomial model best fit was used to check for association between biogeographical zones, type of fortificant, target groups and occasion/frequency of consumption. The Chi squared test was used to check for difference between groups. Descriptive statistics was used to characterize groups.

Conceptual framework and study design

The conceptual diagram (Figure 1.) describes the different steps of the work and the causalities. The study was undertaken in three phases as shown below. This paper presents the literature review and mapping survey results with other elements to be undertaken subsequently (and not reported here in). As a follow-up of assessment of nutritional value of the identified food vehicle, a possible upgrading of the traditional processing will be performed for an optimal bioavailability of nutrients through adequate food formulation and bioavailability studies. Intervention trials will allow choice for easier and more beneficial food to food fortification techniques that can improve nutritional status of vulnerable groups.

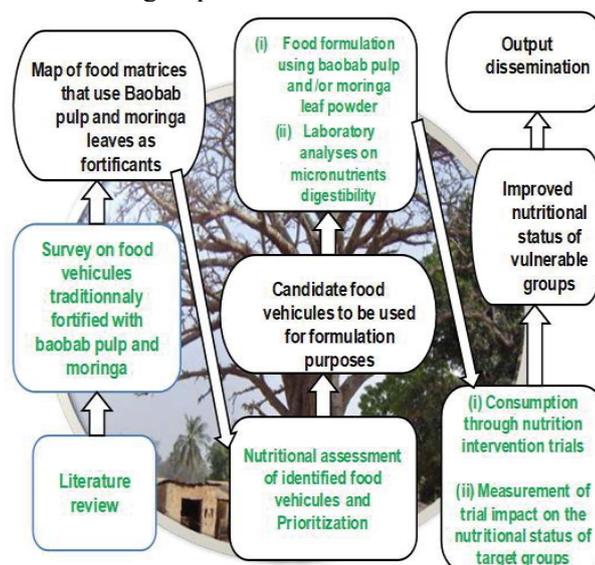


Figure 1: Conceptual diagram of the project

Preliminary findings and implications

Diversity of traditional food matrices that use baobab pulp and moringa leaf powder as fortificants in mother and children feeding. The foods that are traditionally fortified with baobab pulp and or moringa leaf powder in the three biogeographical zones of Benin are numerous and have been grouped in four large categories: Porridge of cereals made from cereals only (maize, sorghum, millet, rice, etc); porridge of legumes made of cereals and legumes (soybean, cowpea, etc.); vegetable sauce (leafy vegetable); and non vegetable sauce (without leafy vegetable and this includes tomato sauce, palm nut sauce, peanut sauce, etc.).

Mother feeding: The use of porridges of cereals fortified with Baobab pulp in mother feeding varies significantly from one biogeographical zones to another (Chi-Sq = 110.756, $P < 0.001$). Porridges fortified with baobab pulp are absent in southern Benin while about 58% of the informants fortify cereals porridges with baobab pulp in northern Benin (Fig. 2a). The use of porridges of cereals fortified with moringa leaf powder (Chi-Sq = 106.265, $P < 0.001$) and the one of vegetable sauce of moringa (Chi-Sq = 106.691, $P < 0.001$) vary significantly from one biogeographical zone to another. In fact, moringa leaves are consumed throughout the country as fortificant in mainly porridge of cereals (about 90% of informants in northern and central Benin against 29% in the south) (Fig. 2b). About 50% of the informants use moringa leaves as legume sauce in southern Benin against 2% in the northern part and 0% in central Benin. On the contrary, the use of moringa as fortificant in non legume sauce is similar in the three zones and does not vary much (between 30-40% of informants) from one zone to another as reported by 30-40% of informants (Chi-Sq = 0.393, P-Value = 0.822). In all cases, Moringa leaf powder is usually added just before consumption or during cooking according to food types.

Children feeding: The use of porridges of cereals fortified with baobab pulp for feeding children varies significantly from one biogeographical zone to another (Chi-Sq = 27.598, $P < 0.001$). In the northern part, 28% of informants use baobab pulp as fortificant in their feeding of children against 5.7% in the central part of the country. The use of baobab pulp as fortificant in legume porridges is very limited in all localities (Fig. 2c). The use of moringa leaf powder in porridges of legume and in non vegetable sauce for children feeding is similar in northern and central Benin (Chi-Sq = 3.432, P-Value = 0.180 and (Chi-Sq = 0.240, P-Value = 0.887, respectively). Indeed, 80 to 98% of the informants traditionally practice this technique for porridges of cereals while about 25% practice it for non vegetable sauce in all biogeographical zones. In contrast, the use of moringa in porridge of legume and as vegetable sauce for feeding children varies significantly from one zone to another (Chi-Sq = 71.758, $P < 0.001$) and (Chi-Sq = 34.507, $P < 0.001$), respectively. Indeed, this practice is absent in southern Benin for porridges of legume against about 5% in the two other zones. With regard to fortifying vegetable sauce, the practice is also absent in central Benin and varies from 5% in northern to 32% in southern Benin (Fig. 2d).

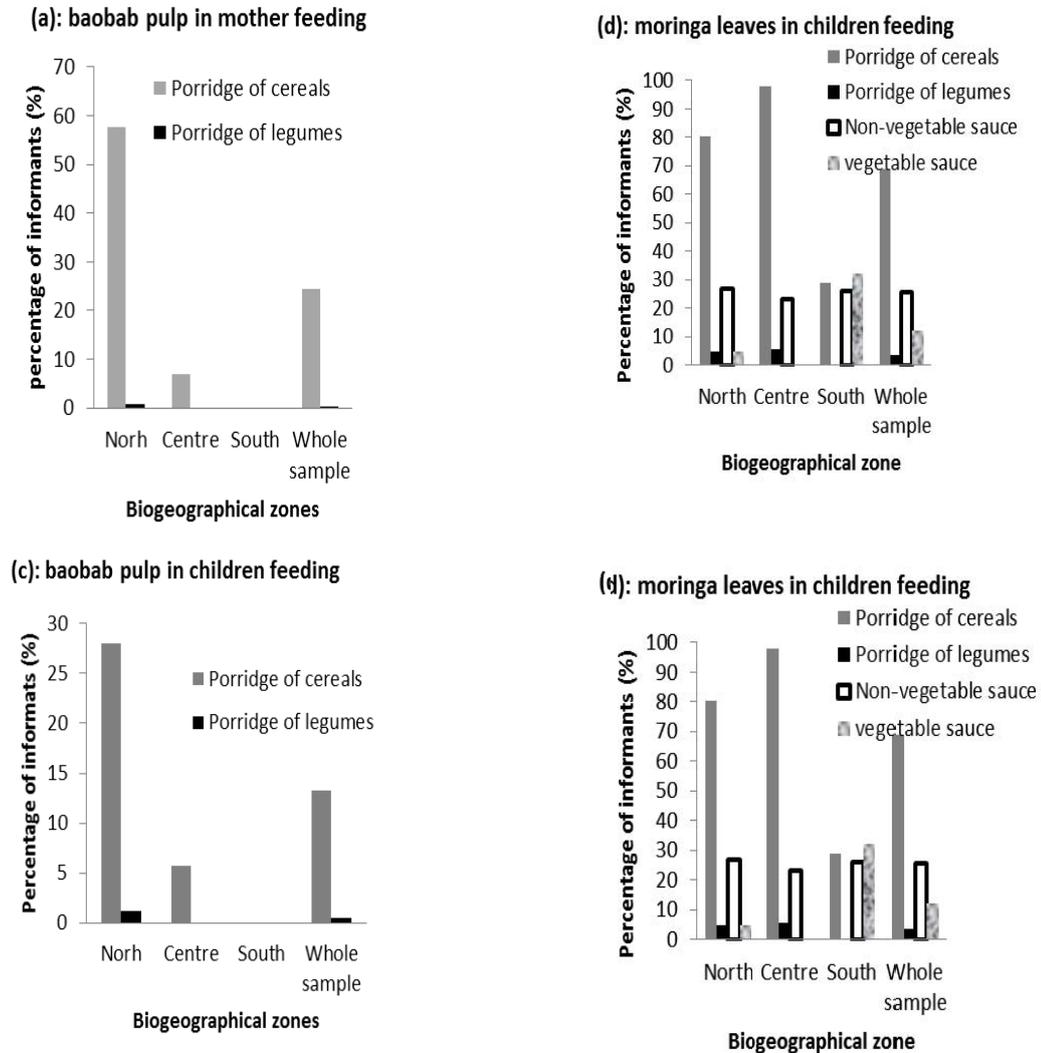


Figure 2. Use in mother (a and b) and children (c and d) feeding of foods fortified with baobab pulp and Moringa leaf powder in biogeographical zones of Benin

The results revealed the specificity of each biogeographical zone according to practices of traditional food to food fortification using baobab pulp and moringa leaves, in women and children feeding. Indeed, different ethnic groups are encountered in the three biogeographical areas of Benin. Since food habits is highly influenced by culture, the use of moringa leaves and baobab pulp in children and mother feeding are no different. According to Wahlqvist (2007), food culture is influenced most by the locality of its origin, which will have been one of food acquisition and processing by various means. Rivera *et al.* (2007), using hierarchical cluster analysis on gathered food plants in the mountains of Castilla-La Mancha in Spain, found that clusters of food

plants species form culture-specific logical entities, which allow people to structure and manage their environment.

Documentation of food vehicles traditionally fortified with baobab pulp and moringa leaves showed that there is a diversity of foods that are used in such a way. In addition, the use patterns vary from one zone to another and per target group and type of fortificant. The project team is committed to continue the work by developing adequate food to food formula and test their nutritional effects on the target groups considering all ethical issues. Dissemination documents will be developed for extension and global sharing.

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