

# Comparative Analysis in Africa and STP Consumers' Attitudes toward Food Security Strategy

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**ABSTRACT**— *The aim of this article is two-fold: (1) firstly, we intend to conduct a very quickly comparative analysis in Africa, in the food security issue, and (2) secondly, to uncover the pattern on San Tome and Principe population consumption. In order to do this we used data collected from questionnaires in 1996, 2002 and 2010 and Latent Class Models for data analysis. As results, (1) concerning comparative analysis we find two clusters, thus finding that African countries are heterogeneous, considering food security issue, and (2) as for San Tome and Principe inhabitants consumption, we concluded that eating habits experienced a great change between 1996 and 2008 in terms of frequency of consumption of food products including meat. This change was influenced by the increases registered in socioeconomic factors such as marital status, status in employment, education level and income.*

*In this study we demonstrate that the basic food products at the three districts that we scrutinize are banana, matabala and breadfruit (local production) and rice (imported and donated). The consumption of local produce (or domestic production) is higher in rural districts. In short, considering the available data on food availability we concluded that the nutritional situation of the country has been experiencing improvements since the year 1996.*

**Keywords**— Food security, Food consumption, San Tome and Principe, Consumption pattern, Sub-saharan Africa, Latent Class Models

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## 1. INTRODUCTION

Investing in agriculture is one of the most effective ways of promoting agricultural productivity, reducing poverty and enhancing environmental sustainability, and making the transition to sustainable agriculture will not be possible without significant new investment to protect and enhance the efficiency of natural resource use and to reduce waste at all stages of production, processing and consumption (FAO 2012).

The persistence of high levels of undernourishment worldwide and recent trends in agricultural prices, production and consumption confirm the major challenges facing world agriculture over the coming decades, notably meeting increasing demand from a growing world population, contributing to eradicating hunger and malnutrition, and preserving the natural resources upon which agriculture and we all depend (FAO 2012); if we are to meet these challenges we need to boost productivity growth in agriculture, and so, ensuring more and better investments in agriculture is a cornerstone in these efforts.

In 2012, at the request of the G20, a number of international organizations jointly prepared a special report on Sustainable agricultural productivity growth and bridging the gap for small family farms (Bioversity et al. 2012). This is a clear illustration of the importance governments place on enhancing productivity growth, particularly of smallholder farms, and the study assesses the challenges of increasing production and calls on governments to step up their efforts to improve sustainable productivity growth in agriculture by encouraging better agronomic practices, creating the right commercial environment and strengthening innovation systems (FAO 2012).

Women comprise on average 43 percent of the agricultural labour force in developing countries, and the female share of the labour force ranges from about 20 percent in Latin America to almost 50 percent in eastern and southeastern Asia and sub-saharan Africa (FAO 2012); the share of rural household heads who are female, many of whom are farmers,

ranges from about 15–40 percent in Latin America, 10–25 percent in Asia, and 20–45 percent in sub-Saharan Africa. For land, the most important asset for agricultural households, the available evidence shows that women represent fewer than 5 percent of all agricultural land holders in the countries of North Africa and West Asia for which data are available.

Not surprisingly, per capita consumption of food has been stagnant in Western Europe and declining in North America, given the already high consumption levels (FAO 2012); however, in sub-Saharan Africa, per capita consumption grew quickly from 2000 to 2005, but higher prices in the latter part of the decade appear to have limited further growth, and per capita consumption in the region was only 11 percent higher in 2012 than in 2000.

From sub-Saharan Africa, Covarrubias, Davis and Winters (2012) and Boone et al. (2012) found that the investment in agricultural assets, including crop implements and livestock, increased satisfaction of household consumption by own production. According to FAO (2012) global trade patterns have changed significantly since 2000 in ways that reflect the underlying trends in production and consumption.

Our research explores the convergence of two different trends in San Tomé and Príncipe: patterns in agricultural production, patterns in population consumption. As for agricultural production we are in the field, collecting data from a questionnaire and some interviews. In this article we deal with consumption, and we used data gathered from questionnaires in 1996, 1998, 2002 and 2010, trying to show the household consumption evolution in this interlude.

## **2. FOOD SECURITY**

### ***2.1 Food Security in sub-Saharan Africa***

Forty-eight percent of the African population is desperately poor – the highest proportion in any region of the world, and per capita food production is declining, and malnourishment and poverty continue to increase (van Noordwijk, Farida, Saiphothong, Agus, Hairiah, Suprayogo and Verbist 2006). Sub-Saharan African cities face enormous challenges heading into the 21st century, yet remarkably, some of these challenges are not fully established as political issues in the debate over urban poverty, urban management, the devolution of government, or popular participation, and urban food security is one such issue (Maxwell 1999).

In sub-Saharan Africa out of poverty, the achievement of adequate nutritional levels is closely linked to agricultural activity. In this region, countries have focused their economic activity in agriculture and the poor live in rural areas. If agriculture has always been the basis of economic life of the people, what reasons have contributed to it that people who are living among the poorest in the world? According to the World Bank Report, 2008 World Development the agricultural sector is responsible for one third of the economic growth in countries whose economic activity is based primarily on agriculture and it is what has allowed in various regions of the globe poverty reduction. Whether the world can assure food security for all by the year 2020 and beyond without degrading the natural resource base depends on our actions today and in coming years (Pinstrup-Andersen and Pandya-Lorch, 1997). International development assistance must be realigned to low-income developing countries, primarily in Sub-Saharan Africa and South Asia where the potential for further deterioration of food security and degradation of natural resources is considerable.

Food insecurity is no longer seen simply as a failure of agriculture to produce sufficient food at the national level, but instead as a failure of livelihoods to guarantee access to sufficient food at the household level (Clover 2003). Food Security is a concept built over the last decades of the twentieth century as the clash of the hunger problem demonstrated the need for wider actions to deal with this scourge of humanity (Ortega and Borges 2012). Food is a basic fundamental need and should be treated as a universal human right (Jenkins and Scanlan 2001). The term food security has gained prominence in the Post-War, particularly in Europe, linked to the idea that in order to address the lack of food supply that which prevailed at that time on the continent, it was necessary to increase the supply of food. In addition to meeting the needs of the population, the increase also contributed to the trade balance of European countries. Was created, so a strong apparatus for farmers (credit and technical assistance) to increase production. The issue of food security, in that moment, we may conclude, was linked exclusively to the ability to produce food of different countries (Ortega and Borges 2012).

The earliest definition of food security emerged from the World Food Conference of 1975 and focused on “the availability at all times of adequate world supplies of basic foodstuffs to sustain a steady expansion of food consumption” (Maxwell and Watkins 2003). By 1986 this had shifted to an emphasis on food access, as shown by the World Bank’s definition of food security as “access by all people at all times to the food required for them to lead a healthy and productive life” (von Braun et al. 1999, p. 34). The four key elements that jointly comprise food security are the availability of food resources, access to those resources, sufficient consumption of food, and appropriate utilization in a sanitary and nutritious manner (Hussein 2002) and without all four elements, food security cannot be assured (Baro and Deubel 2006).

Food security has been promoted by the United Nations (FAO 1996a, 1996b; United Nations Development

Programme [UNDP] 1994) as the most basic human need and as a central indicator of absolute poverty and physical well-being; it refers not only to an adequate aggregate supply of food, but also means that all people at all times have both physical and economic access to basic food.

Food security is commonly defined as access by all people at all times to sufficient food for an active healthy life (World Bank 1986), corroborated by Barrett (2002), with the most common definition of food security: is access by all people at all times to enough and appropriate food to provide the energy and nutrients needed to maintain an active and healthy life.

Food insecurity is greatest in sub-Saharan African countries compared to other developing countries and major reasons include: low agricultural productivity, lack of agricultural policies, poor infrastructure and high-transport costs, lack of appropriate marketing strategies, frequent extreme weather events, high-disease burden including malaria and HIV/AIDS, weak financial support systems, lack of safety net systems and political conflicts (Haile 2005). Africa's population continues to grow at higher rates than on any other continent, and soil fertility depletion is considered as the major biophysical factor limiting per capita food production on the majority of African small farms (Sanchez et al. 1997). Malthus (1926), relates the human pressure on the environment concerning the supply: the population grows geometrically, that is grows more than food production (grows arithmetic) which causes a situation of dire food shortages. Although, overall, the rate of world population growth to be slowly lower the population of sub-Saharan Africa is still growing at 3% per year. As can be seen in Table 1, the estimated population growth for Africa for 2020 will be around 70% while for the developed world, population growth accounts for only 3.8%.

**Table 1:** World Population (million), 1995 e 2020

Region	Population level		Increasing population		Percentage of increased worldwide (%)
	1995	2020	2020	(%)	
Latin America and Caribbean	480	665	185	38,5	10,1
Africa	697	1,187	490	70,3	26,7
Asia, excluding Japan	3,311	4,421	1,11	33,5	60,5
China	1,221	1,454	233	19,1	12,7
India	934	1,272	338	36,2	18,4
Developed countries	1,172	1,217	45	3,8	2,5
Developing countries	4,495	6,285	1,79	39,8	97,5
World	5,666	7,502	1,836	32,4	100,0

Fonte: IFPRI (1999)

Per capita growth estimated for 2020 for sub-Saharan Africa is \$ 359 against \$ 280 in 1995, which represents an increase of \$ 79 (Table 2).

**Table 2:** Levels of income and its growth, 1995 - 2020

Region	Growth rate, the Annual Income (%) 1995 – 2020	Level of income per capita (usd)	
		1995	2020
Sub-Saharan Africa *	3,4	280	359
Latin America and Caribbean	3,59	3,59	6,266
West Asia and North Africa	3,83	1,691	27,83
Southeast Asia	4,44	1,225	2,675
South Asia	5,01	350	830
East Asia	5,12	984	2,873
Developed countries	2,18	17,39	28,256
Developing countries	4,32	1,08	2,217
World	2,64	4,807	6,969

Fonte: IFPRI (1999); \* Excluindo África do Sul

Despite accelerating globalization, food security in most of the developing world depends upon local food production. High and volatile food prices make local production even more important for food insecure regions. With high prices and continually increasing transportation costs, producing more locally will become an important source of vitality for programs focused on reducing poverty (FAO 2007).

In Africa, food production continues growing more slowly than the population, and unlike many other regions of the world, food production per capita is declining since 1970.

To sum up, due to hunger and poverty, a direct result of population growth and insufficient food production, these countries will have as main aspects to consider in food security policy, ensuring production and people's access to food, in a serious attempt to reverse the tendency of malnutrition in Africa (Figure 1).

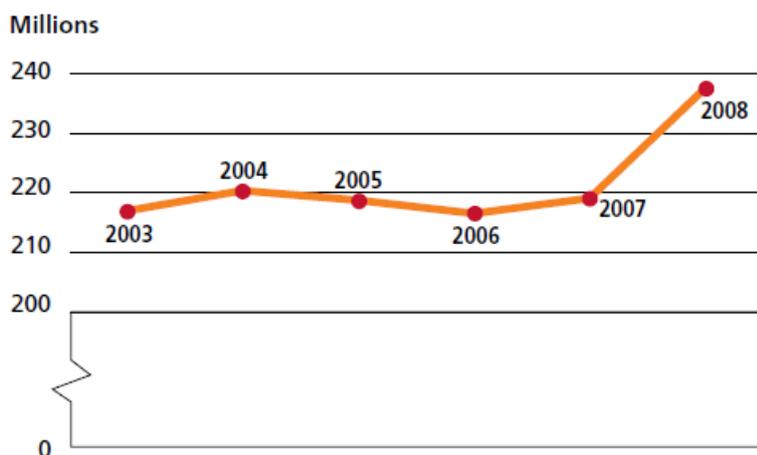


Figure 1: Trends in malnutrition in Africa 2003-2008

Sustained action is required to expand international assistance and improve its efficiency (Pinstrup-Andersen and Pandya-Lorch 1997); if societies continue to act as they have in the past two decades, we can be virtually certain that people will continue to go hungry and malnourished, that children will be underweight, that diseases of hunger and malnutrition will persist, and that the land, forest, and water resources will be mined by people desperate to feed themselves.

## 2.2 Food security in Sao Tome and Principe

Food insecurity STP only be overcome through a serious work of governments, good governance, consistent and sustainable agricultural policies, well-defined strategies and participatory training of farmers to the new challenges facing the world (competitiveness, quality, utilization of market expansion and worldwide niche markets) together with the development of other non-agricultural activities, income generating and employment (tourism, scientific exploration of biodiversity, transshipment activities, oil exploration etc.) (Cardoso 2010).

The PAM food aid provided the proper framework for new farmers (their land parcels) and stimulated the increase of agricultural production in relation to subsistence food. With crises, questioned the resilience of African economies, particularly in sub-Saharan Africa since it concentrates low-income states, namely Mozambique, Democratic Republic of Congo, Sao Tome and Principe, Guinea-Bissau and Cape Verde.

In Sao Tome and Principe food insecurity exists, despite the availability of arable land and favourable climate for agricultural production, but what are the reasons for this situation is just one example among many that are spread throughout the world and specifically across Africa? (Cardoso 2010).

The current food security situation in Sao Tome (such as sub-Saharan African country) should take into account problems (1) the production and availability of food, (2) the population's access to food (distribution), (3) behaviour consumer and (4) the stability of domestic prices.

Sao Tome and Principe in the post-colonial nationalized the fields, turning them into large public companies, however, the inability of management of new officers, ignorance of the ways of production of two major products (coffee and cocoa) led to a huge decreased production not accompanied by an increase in other productions that could increase the food security of their populations (Cardoso 2010). The production is indivisible from the availability of food, because

the availability not only includes the actual production as the ability to import and food aid (including PAM and donations from friendly countries). As part of the aid received by the country in the context of international aid (Table 10) becomes necessary to stress the importance of PAM to national development, especially in agriculture. The PAM comes up implementation of the results achieved in the World Food Conference held in Rome in 1974 under the umbrella of FAO, with the aim of mitigating the effects of the food crisis then and the future in developing countries (Carvalho, 2001).

The external debt resulting from lower exports and the need for systematic resource to imports of food determined the intervention of the International Monetary Fund, the privatization of plantations and agrarian reform by distributing small parcels of land to former workers. These employees who suddenly became smallholders were unable to recover productions that need scale to be profitable (coffee and cocoa), to organize cooperatively to increase their size, or realize that the indiscriminate felling of trees, easy and immediate source of income, determined the order of these productions. Only in recent years some of them managed to start production of organic cocoa, most well quoted in the international market, but has remained dependent on exports, the biggest beneficiaries of that added value (Cardoso 2010).

Security of land tenure is not only a determinant of food production - land is an essential resource for many people if they are to escape poverty. The distribution of land in eastern and southern Africa is so unequal that land reform and land redistribution is essential if there is to be a major reduction in poverty, Clover (2003).

PAM food assistance in São Tomé enrolled under the new policy of privatization of farms and land distribution started in 1993 within the framework of the SAP. The program of privatization and land distribution aimed resize large deficit and agricultural companies, distributing 20 000 hectares of land to small farmers, thus privatizing state farms. In this context, PAM food aid was aimed at supporting new farmers during the first year of its installation to facilitate the exploitation of their land and also be a transitory support to agricultural workers of the state, in addition to their wages very low, encouraging them to work and generate productive capital.

Due to the difficulty of access to import data from previous years to implement the PAM in agriculture we cannot properly assess the impact of this aid at the macroeconomic level. According to informal data, PAM encouraged corn production nationally buying the same product in local producers. This led to the self-sufficiency of the local market for corn which led the country to suspend imports of this product for a few years. To sum up, food aid softened some of the difficulties of land beneficiaries, particularly in the food and financial aspect, helped them adapt to the new situation of owners and especially for women, helped them organize themselves in productive aspect. The findings lead us to these recommendations:

1) A PAM food aid as part of the Structural Adjustment Programme contributed, according to the results and conclusions of this work, for integration and social integration of beneficiaries of land, stimulating production and agro-livestock organization. It becomes necessary to promote the continuation of this aid especially in rural areas.

2) Respondents, to find the period of PAM support in terms of insufficient duration (only 1 year after receipt of the parcels of land), suggested a longer period (over 3 years). This request is logical because the respondents in one year cannot be productive for stability crops such as cocoa, banana, taro, since the production cycle of these crops is greater for perennials and about a year for the banana and taro. The organization of livestock in a year (even poultry) is not enough for a beginner, which is the case of most beneficiaries. In this context, it becomes necessary to review the duration of food aid to small farmers recently. In our opinion, this aid would be more beneficial if covering more time (at least two consecutive years).

3) Finally it is recommended that this support measures is applied alongside other measures including the agricultural credit, given that food aid should be considered in an integrated system of international support for the development of the countries considered underdeveloped or developing.

As is customary in the developing countries or LDCs, NGOs linked to food safety issues arise sustained by development projects financed by international development partners. Most of them are designed by neglecting the sustainability of the beneficiary country, is a temporary and short-lived, considering that it comes to issues of development of a country. With the new structure of agriculture in the country, a result of project implementation of land distribution, there were non-governmental organizations non-profit designed to support small family units and agricultural firms, including support social, economic and technological. Appeared many NGOs supported by small projects for rural and agricultural development, which, because of not taking into account sustainability, disappeared with the end of such projects. Only a few remaining independent such as FENAPA / STP, dedicated to providing support to the organization of row of domestic products and market information, and to ADAPPA e a Quá-Téla, geared towards the processing of agricultural products.

### 3. COMPARATIVE ANALYSIS IN AFRICA

Concerning food security typology with the following six clusters, Lowest Food Security, Low Food Security, Middle Food Security, Upper Middle Food Security and High Food Security, San Tome and Principe was classified as Middle Food Security (Yu, You and Fan 2010). Using data obtained from Eurostat, related to the subject under review, we wanted to reveal the position of STP compared to other countries in Africa, before starting the analysis of STP. To this end, we selected the following variables: Average dietary energy supply adequacy, Average Value of Food Production, Share of dietary energy supply derived from cereals, roots and tubers, Average protein supply, Average supply of proteins of animal origin, Percentage of population with access to improved drinking water source, Percentage of population with access to sanitation facilities, Prevalence of undernourishment, Depth of the Food Deficit and Prevalence of food inadequacy.

Using latent class models as clustering technique, we found two clusters of countries constituted as follows (Table 3).

**Table 3:** Clusters in Africa according to clustering base variables

Cluster 1	Cluster 2
Angola; Botswana; Burundi; Central African Republic; Chad; Comoros; Congo; Ethiopia; Kenya; Liberia; Madagascar; Mozambique; Namibia; Rwanda; Sierra Leone; Sudan (former); Swaziland; Uganda; United Republic of Tanzania; Zambia; Zimbabwe	Benin; Burkina Faso; Cameroon; Cape Verde; Côte d'Ivoire; Djibouti; Gabon; Gambia; Guinea; Guinea-Bissau; Lesotho; Malawi; Mali; Mauritania; Mauritius; Niger; Nigeria; Sao Tome and Principe; Senegal; Togo

Comparing these two typologies we can see that Upper Middle Food Security and Middle Food Security are mainly associated with cluster 2 and Low Food Security and Lowest Food Security are mainly associated with cluster 1. This is in this context that we intend to study feeding behavior of the consumers in San Tome and Principe.

### 4. FEEDING BEHAVIOR OF THE CONSUMERS IN SAN TOME AND PRINCIPE

Food security can be analyzed at the global, national, regional, household, and individual levels (Yu, You and Fan 2010). The history of food security definitions shows that the focus has moved from global and national perspectives to household and individual levels, where the problem of food security emerges in a more concrete way (Maxwell 1996).

The responses of urban households and populations to the economic crisis, and the response of governments to the policy conditionality of structural adjustment, have both contributed to a set of circumstances in contemporary urban Africa where the individual and the household, and sometimes the extended family-but not the state-are the locus of efforts to combat poverty and food insecurity (Maxwell 1999).

Because food insecurity is a multidimensional phenomenon, it is difficult to measure, and measurement requires examination of a combination of related indicators (Frankenberger & Coyle 1993). Some of the proxy indicators commonly used in food security assessments include agricultural production, livestock holdings, landholdings, multiple income sources that typically generate varied amounts of income, daily food consumption in terms of quantity and diversity, local food prices, anthropometric measure measurements of children under five (to assess wasting and stunting), and the degree to which households rely on coping strategies, such as wild plant consumption, seasonal migration and wage labour, and asset liquidation (Baro and Deubel 2006).

Food security is an inherently unobservable concept that has largely eluded precise and operational definition; however, thinking about food security has advanced from a first generation focus on aggregate food availability – the supply side – through a second generation emphasizing individual and household-level access to food – introducing the demand side – toward a nascent third generation conceptualization that places food security in a broader framework of individual behaviour in the face of uncertainty, irreversibility, and binding constraints on choice (Barrett 2002).

Since this is a concept multivariate unobservable, we propose the use of clustering models via latent class models in order to discover the pattern of food consumption of the inhabitants of STP. These reveal several advantages over traditional models of Cluster Analysis (Fonseca 2012).

## 5. METODOLOGY

The study of food consumption is designed to assess the potential access to food through data gathered by means of questionnaire surveys. The information from this study allows us to know the problems of food security of the consumption side and formulate possible responses to the implementation of appropriate policies for their solution.

### 5.1 Data collection

How should household or individual food security be estimated? Consumption surveys would tell us what was consumed (Pinstrup-Andersen 2009). To obtain information on habits and consumption in STP were conducted four surveys by questionnaire, namely in 1996, 1998, 2002 and 2010. The latter were held around the capital in the district of Agua Grande while the 1996 also included the locations of the district Cantagalo of Mé-Zochi of Lembá and Caué. The survey was conducted in 1998 focused mainly to the rural districts (Cantagalo of Mé-Zochi and Lembá). Sample size was 340 in four years, considered statistically representative.

In the food consumption survey, we were careful to separate the frequency of consumption, both in the products consumed most frequently as the products consumed rarely. For closer to reality, information was collected on the consumption of the last week or the week prior to the survey.

### 5.2 Data analysis

The data were statistically processed with the aid of the programs Excel, SPSS 20.0 and Latent Gold 3.0. After processing and handling of data, we propose the use of clustering via latent class models (Fonseca 2012) with the aim of discovering how consumers behave in San Tome and Principe. We used the information criterion AIC3 derived from AIC - Akaike Information Criterion - because our database has only categorical variables (Fonseca and Cardoso 2007).

## 6. DATA ANALYSIS

### 6.1 Behavior of respondents in 1996

We estimated Latent Class Models that allowed us to group the respondents into segments of similar individuals in accordance with the considered clustering base variables. To better characterize the profiles found we used some socio demographic variables as covariates.

Based on analysis in SPSS, the results of the survey conducted in 1996, which covered most of the districts in the country, revealed eight products with high level of consumption including banana, breadfruit, rice and palm oil (declared by more than 95% of respondents), and taro, imported oil, fresh fish and bread (reported by 90 to 95% of respondents) (Table 4). The most commonly consumed meats were pork and chicken, however, only 21.1 and 47.8% of respondents, respectively, produced them (Table 4). In the same framework stresses within the eight main products, the position of imported products, including rice and imported oil, the diet Sao Tome.

**Table 4:** Producing and non-producing (1996)

Products	Producers	Non	Total	%
Banana	80	18	98	81,6
Breadfruit	50	47	97	51,5
Rice	0	97	97	0,0
Palm oil	8	88	96	8,3
Taro	52	41	93	55,9
Imported oil	0	93	93	0,0
Fresh fish	5	87	92	5,4
Bread	0	90	90	0,0
Vegetables	38	51	89	42,7
Bean	19	67	86	22,1
Corn	37	47	84	44,0
Cassava Flour	11	58	69	15,9
Eggs	30	37	67	44,8
Fresh fruit	35	30	65	53,8
Milk	0	38	38	0,0
Pork	16	60	76	21,1
Chicken	32	35	67	47,8
Goat meat	7	37	44	15,9
Beef	0	13	13	0,0

Based on the estimation of latent class models, using LatentGold Software 3.0 for estimation and AIC3 information criterion for model selection, it was found that the model that best describes the respondents, according to the consumption of foods considered (segmentation base variables used in the estimation of the model) was the model with 3 segments, with respectively 58%, 32% and 10% of respondents (Table 5).

**Table 5:** Profiles according to frequency of use (1996)

<b>Food</b>	<b>Class 1 (58 %)</b>	<b>Class 2 (32 %)</b>	<b>Class 3 (10%)</b>
Breadfruit	-	medium; high	rare; low
Banana	medium	rare; low	high
Taro	low	rare	medium; high
Fresh fish	medium	rare; low	high
Dried fish	low	rare	medium; high
Smoked	low	rare	medium; high
Bread	medium	rare; low	high
Rice	-	rare; low; medium	high
Palm oil	high	rare; low; medium	-
Imported oil	-	rare; low	medium; high
Bean	-	rare	low; medium; high
Milk	-	rare	low; medium; high
Eggs	-	rare	low; medium; high
Vegetables	high	rare; low	-
Fresh fruit	-	rare	low; medium; high
Corn	-	rare	low; medium; high
Cassava Flour	-	rare	low; medium; high

Legend: High = All days of the week, average = 4 to 5 days per week, low = 2 to 3 days a week  
Rare = 1 or 0 days per week.

The minority group (10% of total respondents) consumes more frequently banana, taro and fish products (local production), among other products. The other groups, a majority (58%) and intermediate (32%) consume more palm-oil while the highest consumption of imported oil is revealed in the minority group.

## 6.2 Weekly frequency of consumption and its evolution in the district of Água-Grande between 2002 to 2010

On the issue of food consumption, in general, we chose to separate the food products consumed more frequently, that is consumed every day of consumed less frequently each week. In estimating the Latent Class Models, observed the presence of 3 segments of respondents in 2002, regarding the frequency of consumption of different products (Table 6). It was confirmed the relationship of dependence between the consumption of certain foods and income, education, work and marital status. Segment 1 (majority group) comprised 62% of respondents, where the yield is lower, are mostly singles and frequency of consumption of food is low, except for the bread. In contrast there is a third segment (minority) comprising 12% of respondents, characterized by the existence of more respondents married with higher yield and formation, in which all foods disclosed in low power majority group are considered medium and high consumption. Segment 2 (intermediate group), formed by 26% of respondents have an average income, most have a Grade 9 or less and works on their own and find themselves in a relationship and separated. The frequency of consumption of foods differs from the majority group essentially Banana, Fish, Oil-of-palm and rice. These products are most commonly consumed in the second segment (intermediate group). This table clearly shows that the majority of the population surveyed (62%) have great difficulties in achieving a satisfactory and balanced feed. It also notes that, by the fact that this group most individuals with medium level of education, the situation of food is conditioned mainly by low-income and unmarried. See also that the separation of aggregates into 3 groups is fundamentally due to the consumption of fish, eggs, milk, vegetables and fresh fruit. After 8 years (2010), another survey was conducted, whose aim was to understand the evolution of consumption in Água-Grande District.

In estimating the Latent Class Models through the 2010 data highlighted the presence of only two different groups of respondents (Table 7). The dependency relationship between the consumption of certain foods and income, training, working arrangements and marital status remains in 2010. So it is very clear that the minority group (segment 2) consisting of 16% of respondents is the most vulnerable, being characterized by low level of education, most self-employed or are unemployed, and are mostly singles with low income. In segment 1 (majority group, 84% of respondents), where the yield is higher, are mostly either married or separated, those who work for others, with higher frequency of food consumption. The frequency of food consumption differs between these two groups essentially banana, imported oil, fresh fruit and corn products that are most commonly consumed in segment 2 (minority).

**Table 6:** Frequency of consumption for food (2002) in District Água-Grande

<b>Food</b>	<b>Class 1 (62 %)</b>	<b>Class 2 (26%)</b>	<b>Class 3 (12%)</b>
Banana	rare ; low	medium; high	
Taro	-	low	low
Breadfruit	-	rare	rare
Fish	low	medium	high
Palm oil	rare; low	medium; high	-
Bread	high	-	low
Rice	rare; low	medium; high	-
Imported oil	-	rare; low	medium; high
Bean	-	high	rare; low
Milk	low	rare	medium; high
Eggs	low	rare	medium; high
Meat	low	rare	high
Vegetables	low	rare	medium; high
Fresh fruit	low	rare	medium; high
Corn	-	low	low; medium; high
Fuba	-	low	medium; high
Cassava Flour	-	low	medium; high
Covariates			
Marital status	Single	Union and Separated	Married
Employment	-	His Own	Account of Others
Formation	Until mid Course	Until the 9th Class	Degree
Income	Level 2; Level 4	Level 3	Level 5
Expense	Level 4	Level 3	Level 5

Caption: High = All days of the week, average = 4 to 5 days per week, low = 2-3 days a week, rarely = 1 or 0 days a week. Level 1= <170000 Dobras, Level 2= 200000 a 400000 Dobras, Level 3= 500000 Dobras a 700000 Dobras, Level 4= 800000 a 1000000Dobras, Level 5= 1000000 a 2000000Dobras, Level 6= >2000000 Dobras.

The behavior of income in Tables 6 and 7 show that between 2002 and 2010 there was a merger of segments 1 and 2 of 2002. This year there was a part of households with income level equal to 4 in group 1, and in 2010 in the majority group whose income is the same.

**Table 7:** Frequency of consumption for food (2010) in Água-Grande District

<b>Food</b>	<b>Segment 1 (84%)</b>	<b>Segment 2 (16%)</b>
Banana	rare; low	medium-high
Taro	low; medium	rare
Breadfruit	rare; high	low; medium
Fish	high	low; medium
Palm oil	low; high	rare
Bread	high	rare; low
Rice	medium - high	rare; low
Imported oil	rare; medium	high
Bean	low; high	rare
Milk	rare; high	-
Eggs	rare; high	-
Meat	rare; high	-
Vegetables	high	low; medium
Fresh fruit	rare; low	medium - high
Corn	rare	low; high
Fuba	low; medium	rare
Cassava Flour	rare; high	-
Covariates		
Marital status	Married; Separated	Single
Employment	Account of Others	His Own; Unemployed
Formation	10 <sup>a</sup> to Higher Education	until 9 th Class
Income	Till Level 3; Level 6	Levels 2 and 3
Expense	Level 4; Level 6	Level 5

Caption: High = All days of the week, average = 4 to 5 days per week, low = 2-3 days a week, rarely = 1 or 0 days a week. Level 1= <170000 Dobras, Level 2= 200000 a 400000 Dobras, Level 3= 500000 Dobras a 700000 Dobras, Level 4= 800000 a 1000000 DobraLevel 5= 1000000 a 2000000 Dobras, Level 6 = >2000000 Dobras.

### 6.3 Consumption of meat and its evolution in the District of Agua Grande between 2002 – 2010

Concerning the consumption of meat in 2002, showed the presence of three segments respondents according to frequency of use of different types of meat as can be seen in table 8. Thus, it was found a group consisting majority 46.5% (Segment 1), an intermediate with 33.6% (thread 2) and a minority 19.9% (Segment 3) of respondents. In comparative terms, the minority group has better socio-economic conditions characterized by respondents with higher education, higher income and married, while the majority group is the most vulnerable.

Segment 1 is characterized by low frequency of sheep and cattle, pork and conch average (bush and sea) and low / medium chicken; segment 2 is characterized by low consumption and high duck and goat consumption of pork and conch (bush and sea); finally, segment 3 is characterized by low consumption of conch (bush and sea), average consumption of duck, goat, sheep and cattle and high consumption of chicken.

As confirmed by the results presented, there is a dependency relationship between the consumption of meat and certain types of income, education, working arrangements and marital status. In group 3 where economic parameters are better, the frequency of meat consumption is higher with the exception of whelk sea and bush. Consumption of these is more frequent in the intermediate group and the majority group. A more balanced diet is obviously found in the minority group. In 2008 there was a decrease of groups disappearing, so the intermediate group.

**Table 8:** Consumption of meat in the Água Grande district in the year 2002

Meat	Segment 1 (46 %)	Segment 2 (34%)	Segment 3 (20%)
Chicken	low; medium	-	high
Swine	medium	high	-
Duck	high	low	medium
Caprine	-	low	medium
Ovine	low	-	medium
Bovine	low	-	medium
Whelk bush	medium	high	low
Conch sea	medium	high	low
<b>Covariates</b>			
Marital status	Separated; single	Union	Married
Employment	-	His Own	Account of Others
Formation	Average training	until Grade 9	Higher Education
Income	Level 2	Level 3 e 4	Level 5
Expense	-	Level 2 a 5	Level 6

Caption: High = All days of the week, average = 4 to 5 days per week, low = 0 to 3 days a week, Level 1= <170000 Dobras, Level 2= 200000 a 400000 Dobras, Level 3= 500000 Dobras a 700000 Dobras, Level 4= 800000 a 1000000Dobras, Level 5= 1000000 a 2000000Dobras, Level 6= >2000000 Dobras

According to Table 9, came into existence two segments, a majority consisting of 67% and another 33% of respondents. Comparatively, the minority segment has better socio-economic conditions characterized by respondents with higher education, higher income and which are represented in all states of married life, while the majority group is the most vulnerable.

The consumption of pig meat, goat, sheep, cow and duck segment is low in the majority and minority segment in the medium (medium / high in the case of the pig). As regards the consumption of chicken and conchsea, characterized by being low/medium segment and one highest in the segment 2.

According to the results presented in Table 9, there is a dependency relationship between the consumption of meat and certain types of income, education, working arrangements and marital status. In the minority group where socio-economic parameters are better frequency of consumption of meat is higher. A more balanced diet is obviously found in the minority group.

In terms of changes over time, the Conch whose consumption was linked to the most vulnerable, he also became consumed an average frequency by socioeconomic group stronger. Meat of Sheep, Cattle, Goat and duck were and remain low consumption. This is justified by the low availability of these products which gives an imbalance in supply-demand relationship and consequently an increase in price.

In both years there is a minority group with a more balanced consumption consists of 20% and 33% of respondents, respectively in 2002 and 2010.

From the standpoint of evolution there is depreciation in the consumption of chicken meat from more frequent and a little to increase consumption Winkle bush. Studies should be developed and deepened over the increased consumption of conch, because now going to be consumed, regardless of socio-economic population. The results show that dietary habits experienced a major change between 1996 and 2010 in terms of frequency of consumption of food products

including meats. This change was influenced by the change in the socio-economic factors such as marital status, status in employment, education level and income. In 1996, the national level, the most important products in the diet were banana, breadfruit, palm-oil, taro and fish products (local production) and rice and edible oil imported (imported products). The production of local products ranged from 80% to 50% for bananas breadfruit and taro. Milk was the product of lower consumption, only declared by 30% of respondents.

**Table 9:** Frequency of meat consumption in the District of Agua Grande, 2010

<b>Meat</b>	<b>Segment 1 (67,0 %)</b>	<b>Segment 2 (33,0%)</b>
Swine	low	medium-high
Caprine	low	medium
Ovine	low	medium
Bovine	low	medium
Chicken	low; medium	high
Duck	low	medium
Whelk bush	high	medium
Conch sea	low; medium	high
<b>Covariates</b>		
Marital status	Single	Union; married
Employment	His Own; unemployed	Account of Others
Formation	1 to 3	4 to 6
Income	1-3 and 5	6
Expense	Level 3-4	Level 6

Most respondents (57%) had a diet based more on bananas, fish, bread, vegetables and palm oil. The segment had a more balanced diet consists of only 10% of respondents, corresponding to respondents with higher income and higher expenses. The most consumed meat was the swine and poultry. It is, therefore, a diet based essentially on carbohydrates and fat, animal protein and vegetable protein in rather poor.

The situation of consumption in the district of Água - Grande suffered a slight modification until 2002. This year, the frequency of consumption of products of national origin in the diet is low giving way to the rice, fish and bread. In the three existing segments, the consumption is observed with greater frequency in segment 2. In 2010, the segment decreased to 2, which justifies an improvement in food that is less distance / difference in consumption of products.

## 7. CONCLUSION

Regarding the food availability, it was concluded that the available food products of vegetable origin in greater quantity in the country are bananas and taro (in the 90s) (Table 4), banana and breadfruit (in the early 2000). Rice occupies the 1st place among imported, followed by edible oil. These products are in accordance with the data presented in this paper, the basic products to feed the population of Sao Tome and Principe. Between meat and fish, the latter existed in greater quantity in the 90s. Currently the situation is reversed due to increased imports of chicken meat. In 2000, due to a large supply in chicken meat imported, domestic producers were unable to withstand the competition and are quantitatively decreasing.

In quantitative and qualitative terms there was an improvement in consumption and eating habits. Although it remains the minority segment to have a consumption / a more balanced diet of food, there was an increase which went from 10% of respondents in 1996 (Table 5) to 16% of respondents in the district Água-Grande in 2008 (Table 7). Meat of Sheep, Cattle, Goat and duck were and still are mostly low consumption (Table 8, Table 9). This is justified by the low availability of these products which gives an imbalance in supply-demand relationship and consequently an increase in the price. In terms of changes over time, the Conch whose consumption was linked to the most vulnerable groups (Table 8), he also became consumed an average frequency by stronger socioeconomic group (Table 9).

Eating habits experienced a major change between 1996 and 2008 in terms of frequency of consumption of food products including meat. This change was influenced by the improvement recorded in socioeconomic factors such as marital status, status in employment, education level and income. In 1996, the national level, the most important products in the diet were banana, breadfruit, palm-oil, taro and fish products (local production) and rice and edible oil imported (imported products). Milk was the product of lower consumption and the majority of respondents (58%) had a diet based primarily on banana, fish, bread, palm-oil and vegetables. In rural districts, the meats were produced and consumed more chicken and pork, while in urban areas the chicken was consumed with greater frequency.

The consumption of meat (duck, cattle, sheep and goats), milk and eggs depends on the income level and is declared by very few family households in all districts. Households with low economic power and level of education have a higher consumption of poultry, pork and conch. Identical consumption behavior was observed in the rural districts of Cantagalo and Mé-Zochi. It is, therefore, a diet based essentially on carbohydrates and fat, animal protein and vegetable protein in rather poor. The situation of consumption in the district of Água - Grande suffered a slight modification until 2002. This year, the frequency of consumption of products of national origin in the diet is low giving way to the rice, fish and bread.

In short, it can be stated that during the period between 2002 and 2008 there was a change in diet (Food habits) of the population of the district of Água Grande. In the most common level of consumption remained bread, rice and imported oil. The fish and sugar now belong to this level of consumption in 2008. The banana, meat and beans are no longer the most consumed. The frequency of consumption of meat and palm-oil dropped considerably.

The results also show that the frequency of consumption of locally produced products, including banana, breadfruit and palm-oil tends to fall, and imported products, especially rice and oil increase. It was proved by the results of this study, that there are several factors that influence diet family in S. Tomé and Príncipe. Among them, we highlight factors such as production, imports and foreign aid (determinants in food availability), income (which explains the power of purchasing products - access to food) and training (information on nutritional issues and other related health).

We concluded that the basic food products at the three districts are banana, taro, breadfruit (local production) and rice (imported and donated), the consumption of local produce (or domestic production) being higher in rural districts.

The number of households declared of domestic consumers is higher in rural districts, compared to the Agua Grande. It is likely that in the rural districts the consumption of banana, taro and Breadfruit is highly influenced by production. In urban district (Agua - Large) these products are more consumed by households of low economic power and level of training.

Rice and imported oil are consumed too often in all the districts studied. The high frequency of consumption in the rural districts is due to the influence of PAM food aid in communities where small farmers have emerged as a result of the implementation of PPADP.

While high consumption of imported oil could be based on the influence of PAM, the behavior towards palm oil is related to the proximity of the districts of Cantagalo and Mé-Zochi, being factory installed in this oil town of Ribeira Peixe in the neighbouring district of Caué.

In short, considering the available data on food availability it has been concluded that the nutritional situation of the country has experiencing improvements since the year 1996 and it can be concluded that today's population is less nutritionally deprived.

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