

# Assessment of Households' Food Security Situation in Koutiala and San Districts, Mali

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**Abstract** Climate variability and change pose a threat to global food security around the world. This climate change results in the occurrence of extreme events such as droughts, flooding, etc. It becomes more pronounced in Mali. However, most Malian households are vulnerable to coping with the effects of those events. This climatic disturbance affects all sectors in Mali such as agriculture, livestock, etc. Thus, those sectors are the main sources of food production for many households in the country. In fact, several factors contribute to food insecurity in many areas of Mali including drought, flooding, low agricultural yield, terrorist attacks, and power instability. Among the affected areas in Mali, included Koutiala and San districts. The main goal of this study is to assess the level of households' food security status in the Koutiala and San districts. The specific objectives are: (i) to assess the households' food security index in the study area; (ii) to determine the main factors that drive the households' to food insecurity; and (iii) to identify the households coping strategies to face food insecurity. Therefore, a field survey was conducted with a sampling of 455 households' from eight (8) villages (M'Pessoba, TarassoII, Sougoumba, N'Tosso, Tene, Sourountouna, Koro, and Dieli) within Koutiala and San districts. Therefore, CARI (Consolidated Approach to Reporting Food Security Indicators) approach was used for measuring the household's food security status. SPSS software was used for data processing. It appears from the findings that in the food consumption score, most of the households have an acceptable (99.8%) score and only a poor (0.2%) score. In the households' food expenditure share, 100% of them spend less than 50% on food. The results (Table 3) show that (97.8%) of households are marginally food secured, only (2%) of them are food secured, and (0.2%) are moderately food insecure. The cows' ownership and work for cash were the main factors of households' food security which have a positive influence on households' food security. The main constraints faced by households' food security were the increase in agricultural inputs price (91%), the difficulty of food availability (89.5%), an increase in food price (88.1%), rainfall variability (84.2%), income reduction (79.1%), debt payback (52.5%), effects of natural disasters (drought, flood) (50.8%), and human insecurity (46.4%). The food insecurity coping strategies based on food consumption were to borrow food (36%), reduce the amount of food consumed by adults to feed children (31%), reduce the number of meals per day (28%), use less popular and expensive foods (23%), limited the size of portions during meals (22%), and going a whole day without eating (9%). Moreover, the food insecurity coping strategies are based on households' livelihoods, such as emergency (64.4%), crisis (33.6%), stress (1.8%), and none strategy (0.2%).

**Keywords:** households', food security, climate change, CARI, Mali, Koutiala and San

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## 1. Introduction

The IPCC report published in 2013 stated that the world might reach "a threshold of global warming beyond which current agricultural practices [1]. That can no

longer support large human civilizations" by the middle of the twenty-first century [2].

The West African Sahel became a globally recognized political entity following the famine in the early 1970s [3]. When it endured the most outstanding, abrupt climatic shift of the instrumental record [4] in the sudden onset of persistent drought. Evidence is accumulating that

anthropogenic contribution to this shift may have been significant and attributable to the effect of sulfate aerosol-induced cooling of the North Atlantic [5,6,7]. This aggravated greenhouse gas-induced warming of the tropical oceans [8,9,10]. Continued drought is not a warranted outcome of global anthropogenic interference with the climate system [11], as the most recent years of repeated regional flooding suggest [12]. However, the magnitude and severity of the Sahelian drought of the 1970s and 1980s, and its impact on agricultural development strategies and on food security provide an opportunity to examine the relationship between climate and livelihoods, and to build an evidence base of adaptation options available to at-risk populations in a context of increasing exposure and sensitivity to a highly variable climate.

The Malian economy is still largely dependent on agriculture, measured by the contribution of agriculture to the national gross domestic product [36.9% in 2006; [13]]. A majority of the population engages in agriculture [66% in 2006; [13]], and derives the largest fraction of income from agricultural production. This is about the median value of 70% of income among the rural households surveyed here. Mali and its neighbours' are among a minority of sub-Saharan African countries which have met or surpassed the target of 10% of government expenditures going to agricultural development set by the Africa Union's Comprehensive Africa Agriculture Development Program [13]. Yet, among the staple crops cultivated, apart from irrigated rice, agricultural production in Mali is rain-fed. Therefore, it is highly sensitive to climate [14,15]. In the last decades, Malian households have been exposed to a series of shocks and stresses, such as irregular rainfall, droughts, flash floods, strong storm and winds, the incidence of pests, and poor harvests. Cereal production has increased at the same rate as the population over the last decade, with imports contributing to only 5% of the national cereal budget, and dependence on food aid has decreased from 4 kg of cereal per person in 1990 to 0.5 kg/person in 1999 [16]. These aspects all contributed to the resilience shown by Malian households to the 2008 global food price crisis [17,18]. These aspects all contributed to the resilience shown by Malian households to the 2008 global food price crisis [17,18]. These shocks coupled with the effects of the on-going terrorist attacks till 2012 have increased households' vulnerability to poverty and food insecurity for the whole country. Regarding these issues, this study's aim is to find out the households' food security situation in the Koutiala and San districts in order to make strong decisions about coping to face those effects.

### 1.1. Objectives

The overall objective of this study is to contribute to improving household food security in Mali.

### 1.2. Specific Objectives

The specific objectives are:

- i) to assess the households' food security index in the study area;
- ii) to determine the factors that drive the households' to food insecurity;
- iii) to identify the households' coping strategies to face food insecurity.

The results of this study will be useful for the Government, World Food Program (WFP), Food and Agricultural Organisation (FAO), scientists, students, farmers, and other humanitarian and development partners to develop food and/or agricultural assistance programs that are better targeted and adapted to the needs of food insecure populations.

## 2. Methodology of the Study

### 2.1. Study Area

This study is implemented in two districts of Mali, namely Koutiala (Sikasso region) and San (Segou region) (Figure 1). This area (Southern Mali) occupies 13.5% (approximately 160.825 km<sup>2</sup>) of the Malian territory and represents 50% of the cultivable lands of the country and holds 40% of the Malian population [19].

Koutiala District is in the heart of the old cotton basin and occupies the western part of the Sikasso region. It is bounded on the north by San District, northwest by Bla, and southwest by the Dioïla District, to the south by the district of Sikasso and the Republic of Burkina Faso, and on the east by the District of Yorosso. The geographical location of the district is 12°23'N 5°28'W.

The Koutiala district covers an area of 8,740 km<sup>2</sup> with a population of 797,927 inhabitants. The climate is tropical sub-Saharan and characterized by two seasons in a year: a dry season from November to April and a rainy season from May to October. The rainfall in Koutiala ranges from 750 to 1000 mm per year. The rainy season lasts from June to October, with rainfall peaking in August. The dry season comprises a relatively cold period from November to February and a hot period lasting from March to May. The average maximum temperature is 34°C during the rainy season and 40°C during the hot, dry period [20]. The district has neither a river nor large lakes, yet we can distinguish between surface water and wells, generally fed by rainwater [21,22,23].

The district of San is part of the semi-arid zone and is characterised by a Sudan-Saharan climate. It has a surface of 7,262 km<sup>2</sup> with a population of 335,000 inhabitants. Its geographical location is 13° 10' 44.2" N 5° 0' 58.2" W. It has a tropical dry weather with an average maximum temperature of 44°C, and the lowest temperatures are 13°C. This district is hot on average all year round; with the warm months being March and May. November to February is the coolest month. The rain season occurs with the peak in June, July, August and September. The annual average rainfall is around 500 mm per year [21,22,23].

The following Figure 1 is about the presentation of the study areas where this study was conducted

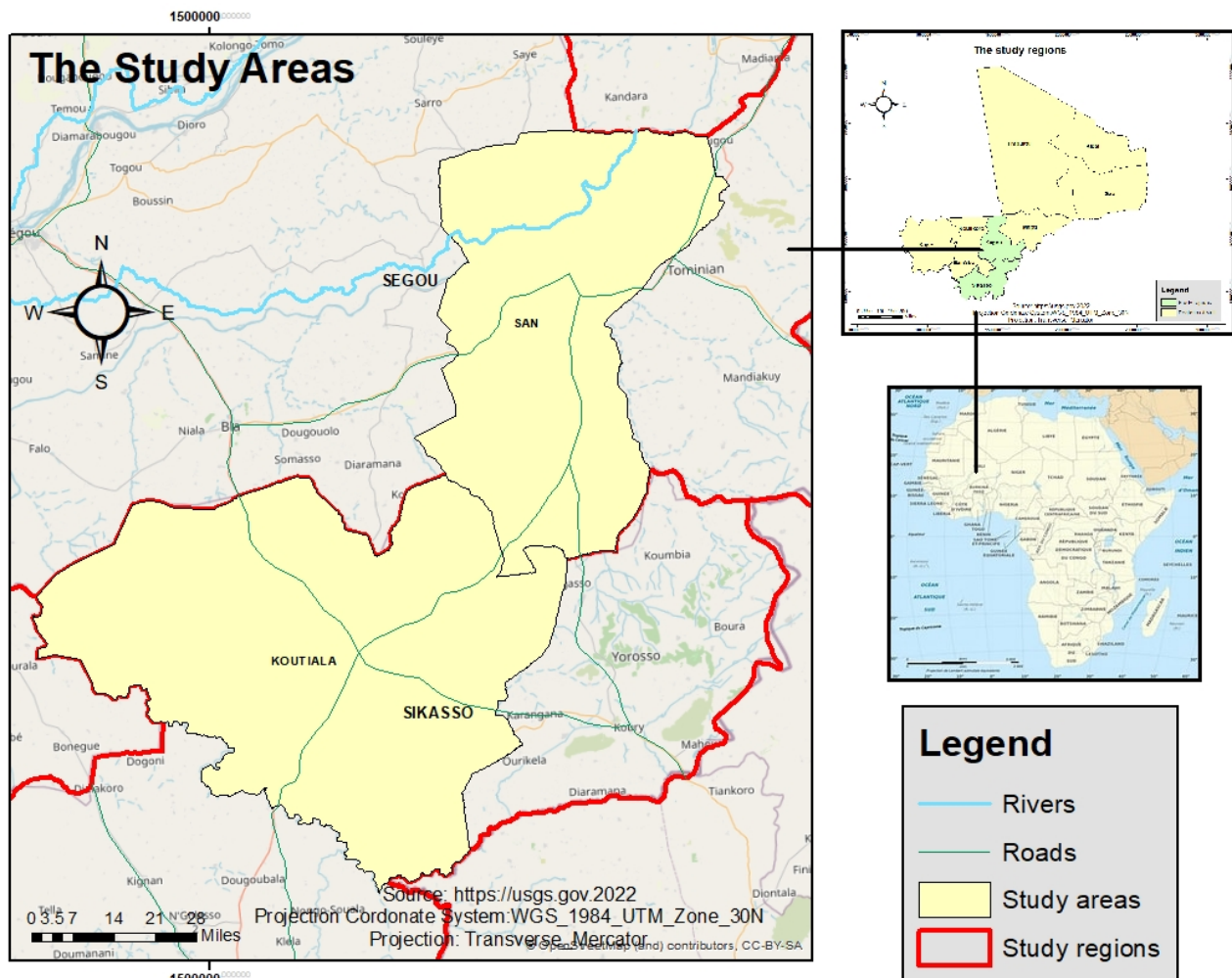


Figure 1. Study area (Koutiala and San districts) (Source: Personal work)

## 2.2. Methods and Material

### 2.2.1. Material

For this study, a household questionnaire was developed. This was used to collect data on the socio-economic characteristics of households, household food consumption, and constraints affecting households. For data collection, the tools for processing and analysing the data were computer software, notably: CommCare version and data entry; SPSS for statistical analysis; Geographic Information System (GIS) for mapping; and Microsoft Office (Excel, word) for graphics and the preparation of the dissertation document.

### 2.2.2. Analysis Methods

#### 1. Households' food security index

We use the CARI approach newly published by WFP in February 2014 to understand food security in all its dimensions. This approach makes it possible for this approach allows food security indicators to be combined in a systematic and transparent way in order to establish an explicit classification of households.

Based on CARI, each surveyed household was classified according to a composite food security index whether food secure, borderline food secure, moderately food insecure, or severely food insecure. The

classification algorithm takes into account the household's current food consumption and its potential to sustain its consumption in the future. As shown in the Table 3, the food insecurity index results from the combination of the diversity and frequency of household food consumption in the last 7 days before survey, the share of expenditure that the households allocate to food, and coping strategies to face food insecurity in the last 30 days before the survey

#### • Households' food consumption score (FCS)

The Food Consumption Score (FCS) is a composite score based on the diversity, frequency, and relative nutritional importance of different food groups. That assesses the frequency of consumption of foods and food groups in the 7 days before the data collection and the sources of food. It is obtained through the following formula:

$$\begin{aligned} \text{FCS} = & \text{aicerealexicereale} + \text{aivegetablexivegetable} \\ & + \text{aifruitxifruit} + \text{aianimalxianimal} \\ & + \text{aisugarxisugar} + \text{aimilkximilk} + \text{aioilxioil} \end{aligned} \quad (1)$$

Where **ai** = Weight of each food group

**xi** = Frequency of consumption of food (number of days that feed *i* was consumed in the last 7 days).

The score is compared with predefined thresholds to classify households into food consumption profiles as shown in Table 1.

**Table 1. Predefined thresholds for food consumption profiles**

Thresholds	Profile	Thresholds taking into account a daily consumption of sugar and oil (7 days per week)
0 – 21	Food consumption Poor	0 - 28
21,5 - 35	Food consumption at the limit	28,5 – 42
>35,5	Acceptable food consumption	> 42,5

Source: [24].

The profile of each household is then converted into the four levels CARI scale as shown in the Table 3.

#### • Households' food expenditure share

When the survey cannot generate data on the poverty line, economic vulnerability is measured using the food expenditure share indicators. This indicator (share of food expenditure) is simply constructed by dividing total food expenditure by total household expenditure.

$$\text{food expenditure share} = \frac{\text{food\_monthly}}{\left( \text{food\_monthly} + \text{nonfood1\_monthly} \right) + \text{nonfood2\_monthly}} \quad (2)$$

#### • Household' coping strategy categories

The ability of a household to respond to shock as well as to hazards depends on the level of its natural, material, economic, human, social and political assets, the level of its production, his/her income, consumption, but also how they can diversify their sources of income, and consumption to mitigate the effects of disasters that may occur at any time. This indicator is calculated from the coping strategies used by households in the 30 days prior to the survey. WFP recommends that a total of 10 strategies (4 stress, 3 crisis, and 3 emergency strategies) be considered according to the local context, using the reference list of livelihoods-based coping strategies. The classification of households into the different strategy categories is based on the principle of the most severe coping strategy used by the household. In the CARI scale, households that have not used any of the selected strategies are considered to be food secure, while households that have used the stress, crisis, or emergency strategies are classified as borderline food secure, moderate food insecure, and severe food insecure, respectively.

The strategies selected for this study are presented in Table 2.

**Table 2. List of strategies selected for the livelihoods-based coping strategies**

Strategies	Categories
Reducing expenditure on non-essential items (drink, ceremonies, clothes, meat, sugar, more expensive staple foods, etc.)	Stress
Sales of animals (at levels that maintain the sustainability of the herd)	Stress
Borrowing food or money	Stress
Sale of non-productive goods (jewellery, clothes, etc.)	Stress
Consumption or sale of seeds	Crisis
Reduced expenditure on production inputs (fertiliser, veterinary care, etc.)	Crisis
Reduced spending on health, education	Crisis
Excessive sale of livestock (breeding stock)	Urgency
Sale or mortgage of productive assets (land, tools, etc.)	Urgency
Recourse to illegal activities (prostitution, theft, etc.)	Urgency

Source: [25].

#### • Food security index

The households' food security index is obtained from an algorithm based on simple averaging calculations using the scores achieved for each indicator on the four-point scale. Households classified as food secure, borderline food secure, moderately food insecure, and severely food insecure take scores of 1, 2, 3, and 4 respectively. Specifically, the ranking of each household is based on a simple average of the Current Status score (consumption score) and the Survival Capacity score. The latter score is itself a simple average of the food expenditure share score and the asset depletion score (Table 3). The average obtained is rounded (between 1 and 4) and this figure represents the household's food security index.

The CARI reporting table, the final product of the CARI method, summarises the distribution of the different food security indicators and indices. Table 3 presents a typical CARI reporting table constructed from standard WFP indicators.

**Table 3. CARI reporting template with standard WFP indicators**

Domain		Indicator	Food secure (1)	Marginally food secure (2)	Moderately food insecure (3)	Severely food insecure (4)
Current status	Food consumption	Food consumption score	Acceptable		Borderline	Poor
Coping Capacity	Economic vulnerability	Food expenditure share (of total expenses)	Part < 50%	50-65%	65-75%	Part > 75%
	Asset depletion	Livelihood coping strategy categories	None	Stress	Crisis	Emergency
Food insecurity Index						

Source: [25].



## 2. Factors affecting the households' food security

This part was approached through an inventory of the different factors that affect household food security as well as the links between them through correlation and binary regression analyses in order to identify the determinants of household food insecurity.

Therefore, we preceded the Chi2 test at the 5% level to check the significance of the links between the different factors (variables) and household food security.

P-value  $\leq \alpha$ : variables show a statistically significant association (reject H0)  $\alpha$ : significance level of 0.05.

If the p-value is less than or equal to the significance level, you can reject the null hypothesis and conclude that there is a statistically significant association between the variables.

P-value  $> \alpha$ : impossible to conclude that the variables are associated (do not reject H0)

If the p-value is above the significance level, you cannot reject the null hypothesis because you do not have enough evidence to conclude that the variables are associated.

Multi-variate analysis using a binary logistic regression model with household food security as the variable to be explained. The structure of the model representing the food security index is quantitative.

$$p = \Phi(\beta Xi) = \frac{\exp(\beta Xi)}{1 + \exp(\beta Xi)} \quad (3)$$

With, P the dependent variable taking the value 1 if are food secure and 0 otherwise,  $\beta_i$  is the vector of parameters to be estimated, Xi is the vector of household explanatory variables  $\Phi(\beta Xi)$  the probability that the household is food secure and Exp is exponential.

The evaluation of the model was based on likelihood tests (double log-likelihood and goodness-of-fit). The parameters of the regressions are also tested by the Wald statistic which is distributed according to the chi2 distribution with a degree of freedom.

## 3. Households' coping strategies to face food insecurity

The methodology adopted for this section is structured as follows: in the face of shocks and food shortages, households do not remain passive but try to shocks and food shortages, households do not remain passive but try to adapt by developing strategies. The analysis of household coping strategies is based on the CARI approach, which distinguishes four categories of strategies (no strategy, stress strategies, crisis strategies and emergency strategies).

### Identification of Coping Strategies

#### • Food coping strategies

In the event of shocks, households resort to coping strategies to build resilience to build resilience. The frequency of these strategies is assessed over a period of 7 days of consumption.

Households resort to coping strategies such as resorting to less preferred foods, borrowing food, reducing the number of meals per day, limiting the number of

borrowing food, reducing the number of meals per day, limiting the size of portions during meals the size of the portions during meals, reducing the amount of food consumed in favour of children, sending household members away to eat and going a whole day without eating day without eating.

#### • Non-food coping strategies

With regard to the use of non-food strategies, households were classified into 4 groups according to the CARI approach:

- **Those who did not use non-food** strategies during the reference period the reference period;
- **Stress strategies:** stress strategies lead to a reduction in the ability to cope with future shocks (Sell household assets/property as radio, furniture; borrowing money; spending savings; having sold more non-productive animals than non-productive animals than usual);
- **Crisis strategies:** Crisis strategies directly affect future productivity. These include selling productive assets or means of transport (e.g., bicycles, wheelbarrows); reducing essential non-food expenditures such as education, health care and education, wheelbarrow...); reducing essential non-food expenditures such as education, health; withdrawing children from school;
- **Emergency strategies:** emergency strategies affect future capacity to produce and are more difficult to and are more difficult to reverse than the previous ones. These include resorting to begging; selling the last productive females; selling the house, selling the house, plot of land or field.

## 4. Sampling procedure and size

The multisampling procedure was employed. In the first step, the area of the study (Koutiala and San districts) was selected purposively owing to the presence of the main agricultural farmers and their high vulnerability levels to climate variability and change. In the second step, eight (8) villages (M'Pessoba, Sougoumba, N'Tosso, Tarasso II, Sourountouna, Tene, Koro, and Dieli) were randomly selected from both districts in the southern part of Mali. Therefore, we have also taken into account the agro-ecological, socio-economic, and environmental attributes in the different districts. This work was facilitated through the support of agricultural, forestry, livestock, and NGOS services in the area. The third and last step was to conduct the household surveys by using the random sampling approach. Therefore, we have used semi-structured questionnaires for the survey with a total of 455 household heads as sampling.

The number of households (n) to be surveyed was determined by the Slovin 1960 [26] formula below:

$$n = \frac{N}{1 + Ne^2} \quad (4)$$

By applying the SLOVIN formula:

With n: expected sample size

N: total number of households: 51, 136 [13]

e: error (7%)

Table 4. Households sampling selection procedure

Number	Selected agro-climatic zones	Selected region	Selected circle	Number of households/circle	Sampling household	Selected villages
Sahara zone						Tene (59)
Sahel zone	Sudan-Sahelian zone	Segou	San	23, 399	179	Sourountouna (33)
Sudan zone						Koro (55)
						Dieli (32)
						N'Tosso (38)
Sudan-Guinean zone	Sudan-Guinean zone	Sikasso	Koutiala	27, 737	276	Sougoumba (80)
						Tarasso II (59)
						M'Pessoba (99)
	2	2	2	51, 136		455

Source: [27].

### 3. Results and Discussion

#### 3.1. Results

The analysis of food insecurity in this report is based on the conceptual framework for food insecurity and vulnerability analysis adopted by World Food Program (WFP) in 2014.

The final product of the approach developed, called CARI, is a food security reporting table that allows for the presentation of results and the combination of food security indicators (food consumption score, food expenditure share, and livelihood coping strategy categories). Central to this approach is an explicit classification of households into four groups (food secure, borderline food secure, moderately food insecure, and severely food insecure). This classification provides an estimate of food insecurity within the target population calculated at the national or sub-national level or for other strata (e.g. livelihood activities, gender of household head).

##### Households' socio-economic characteristics

In the study area, all of the household's heads (100%) are men. According to the National Food and Nutrition Security Survey [28], in Mali, the majority of households are headed by men (94.5%) which indicates stability for this indicator compared to the previous surveys (93.7%) and 93.4% in September 2019 and February 2018.

The distribution of the respondents by age as shown in Table 5 reveals that more than half of the respondents (51.4%) were between the age group of 41 and 60 years, (32.7%) of them were between the age group of 18 to 40 years. While (15.4%) and (0.4%) of the respondents were between the age categories of 61 to 80 years and 81 to 83 years respectively.

Table 5 shows that most of the respondents are married (91.7). While widower (3.5%), divorced (2.4%), and separated (2.2%).

Regarding households' family size, 45.6% of them have an average number of 6- 11 persons in the house, 29.6% (12-17 persons), and 15.4% (2 -5 persons). The majority of respondents (38.2%) are not educated, 19.5% have got a primary level of education and only 7% of them have a secondary level.

Table 5 revealed that (100%) of respondents practice farming activities as the main activity and 94.7% of them also practice livestock activities. While the activities such as fishing, trading, and handwork are slowly practiced in the study area.

Table 5. Socio-economic characteristic of households'

Variables	Frequency	Percentage
<b>Age</b>		
18 to 40	149	32.7
41 to 60	234	51.4
61 to 80	70	15.4
81 to 83	2	.4
<b>Sex</b>		
Male	455	100.0
Female	0	0
<b>Household size</b>		
2 to 5	70	15.4
6 to 11	208	45.6
12 to 17	135	29.6
18 to 22	31	6.8
>22	11	2.4
<b>Marital status</b>		
Married	418	91.7
Divorce	11	2.4
Separated	10	2.2
Widower	16	3.5
<b>Level of education</b>		
Primary school	137	19.5
Secondary school	49	7.0
Not educate	269	38.2
<b>Main activities</b>		
Farming	455	100
Livestock	432	94.7
Fishing	10	2.2
Trading	6	1.3
Artisan	7	1.5

Source: Field survey (2021).

#### 1. Households' food security index

##### • Households food consumption score (FCS)

Table 5 shows that the proportion of households categorized as having an acceptable food consumption score is 99.8%. Averages of 0.2% of households have a severe food consumption score in both districts.

##### • Households' food expenditure share

Regarding the households' food expenditure (Table 5), 100% of households, were less than 50% of total expenditure shares in both districts.

### • Livelihood coping strategy categories

The results (Table 6) reveal that more than half (64.4%) of households have an emergency coping strategy category, (33.6%) crisis, (1.8%) stress, and only (0.2%) none strategy in both districts.

Table 6 presents the prevalence rates of different types of food insecurity in the population. Based on this approach, the analysis of the survey data shows that (97.8%) of households are marginally food secure, (2%)

of households are food secure, and (0.2%) of households are moderately food insecure in Koutiala and San districts respectively. This pattern of results shows that a significant proportion of the population is food insecure and could quickly fall into a situation of severe food insecurity in the event of shock affecting their livelihoods. The difficulties inherent in the crisis that the country is going through have weakened the livelihoods of households and considerably reduced their capacity to cope with shocks.

**Table 6. Consolidated Approach for Reporting Indicators (CARI) of Food Security in both districts (Koutiala and San)**

Domain		Indicator	Food secure (1)	Marginally food secure (2)	Moderately food insecure (3)	Severely food insecure (4)
Current status	Food consumption	Food consumption score	<i>Acceptable</i> 99.8 %		<i>Borderline</i> 0	<i>Poor</i> 0.2%
Coping Capacity	Economic vulnerability	Food expenditure share (of total expenses)	<i>Part &lt; 50%</i> 100 %	<i>50-65%</i> 0	<i>65-75%</i> 0	<i>Part &gt; 75%</i> 0
	Asset depletion	Livelihood coping strategy categories	<i>None</i> 0.2 %	<i>Stress</i> 1.8 %	<i>Crisis</i> 33.6 %	<i>Emergency</i> 64.4 %
<b>Food insecurity Index</b>			<b>2 %</b>	<b>97.8%</b>	<b>0.2%</b>	<b>0</b>

Source: Personal work.

## 2. Determinants of households' food security

### • Determinants

The results show (Table 7) that the explanatory variables as the age of households', level of education, family size, marital status, religion, bird ownership, sheep ownership, farm size, use of improved varieties of crops, fishing activity, hand worker, exodus, and financial help are not significant. These variables do not have effects on households' food security. However, households that ownership of cows and work for cash have a positive influence on households' food security (Table 7).

**Table 7. Main factors that correlating with households' food security in the study area**

Variables in the Equation	Coefficients	Error Standard	Statistics of Wald	Probability.
Age	.000	.036	.000	1.000
Level of education	.404	.370	1.196	.274
Family size	-.093	.101	.845	.358
Marital status	.114	.694	.027	.870
religion	.539	.745	.524	.469
Bird ownership	.025	.019	1.819	.177
Sheep ownership	-.064	.045	1.996	.158
Cow ownership	.080	.031	6.715	.010**
Farm size	17.389	6.1343	.000	.998
Improve varieties	-.824	.804	1.048	.306
Fishing	-1.403	1.844	.579	.447
Hand worker	-15.747	1.1904	.000	.999
Exodus	1.290	1.181	1.194	.275
Financial help	-1.416	.921	2.363	.124
Work for cash	1.233	.693	3.164	.075*

Source: Personal work

\*\* Significant at the 5% level

\* significant at the 10% level.

### • Constraints faced to households food security

Table 8 shows that the increase in agricultural inputs price, the difficulty with food availability, increase in food price, rainfall variability, income reduction, debt payback, effects of natural disasters (drought, flood), and human insecurity were observed as the main constraints to food production for the respondent with the percentages of (91%), (89.5%), (88.1%), (84.2%), (79.1%), (52.5%), (50.8%), and (46.4%) respectively (Table 7). These constraints are known to be a serious challenge in food production in recent years due to climate change.

Table 8. Constraints faced to households in Koutiala and San districts

No	Variables	High shock	Low shock	Not a shock
		%	%	%
1	Difficulty for food availability	9.5	89.5	1.1
2	Income reduction	79.1	20.4	.4
3	Increase of food price	88.1	11.6	.2
4	Increase of agricultural inputs price	91.0	8.8	.2
5	Human insecurity on the ground	46.4	10.1	43.5
6	Debt pay back	42.9	52.5	4.6
7	unemployment	36.9	57.1	5.9
8	Effects of natural disasters (drought, flood)	50.8	45.9	3.3
9	Rainfall variability	84.2	14.3	1.5

Source: Personal work.

### 3. Households' coping strategies to face food insecurity

#### • Food insecurity coping strategies through food consumption

In the seven days prior to the survey, households used one or more of the following coping strategies, including borrowing food (36%), (31%) reducing the amount of food consumed by adults to feed children, (28%) reducing the number of meals per day, (23%) use of less popular and expensive foods, (22%) limited the size of portions during meals, and (9%) going a whole day without eating (Figure 2).

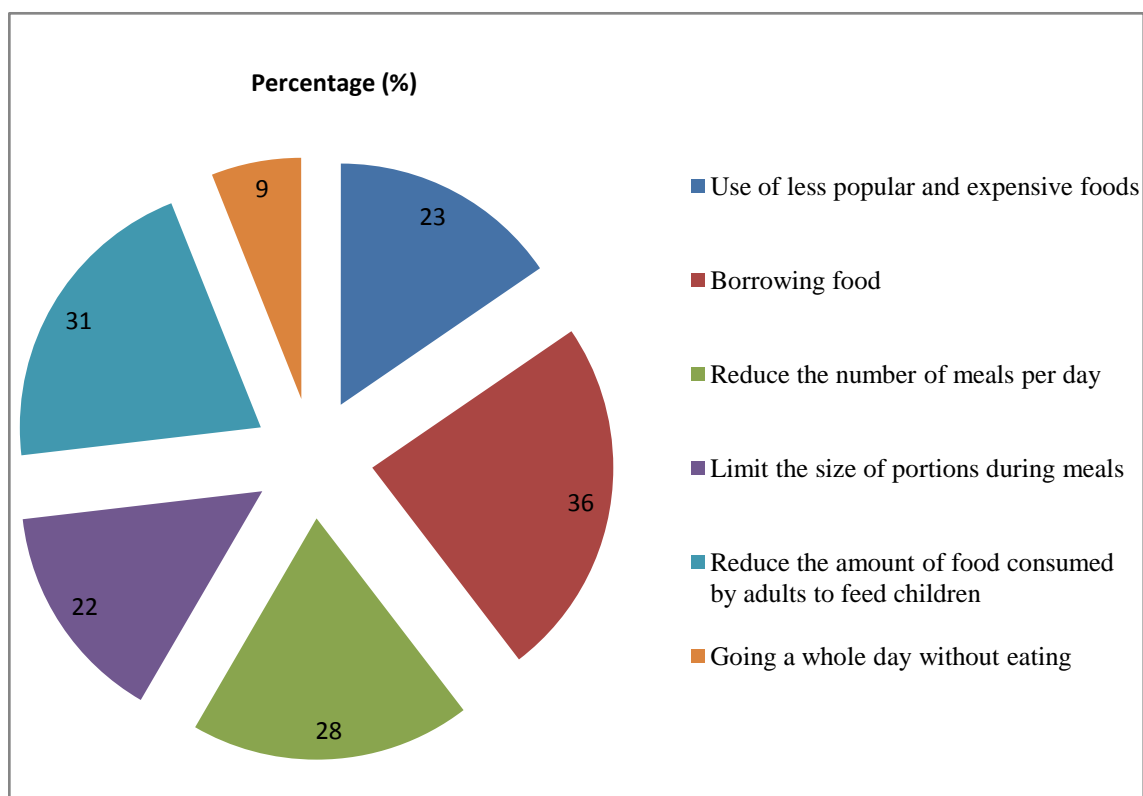


Figure 2. Household food coping strategies (Source: Personal work)

#### • Food insecurity coping strategies through livelihoods

Shocks, whether natural or otherwise, can have devastating effects on household food security. Households can use a range of coping strategies to overcome a period of hardship. The index of livelihoods-based adaptation in an emergency is high (64.4%) than in a crisis (33.6%), stress (1.8%), and no strategy (0.2%).

**Stress strategies:** stress strategies lead to a reduction in the ability to cope with future shocks (Selling household assets/property such as radio, furniture); borrowing money;

spending savings; having sold more animals non-productive than usual);

**Crisis strategies:** crisis strategies directly affect future productivity; it is a question of selling productive goods or means of transport (bicycle, wheelbarrow, etc.); reducing essential non-food expenditures such as education, and health; withdrawing children from school;

**Emergency strategies:** emergency strategies affect the future capacity to produce and are more difficult to reverse than emergency strategies. These include resorting to begging; selling the last productive females; selling the house, the plot of land, or the field.



Table 9. Implementing livelihoods-based adaptation strategies

Non-food coping strategies	Percentage (%)
Reduces non-food expenditures on health (including medicines) and education (Crisis)	58
Sold productive goods or means of transport (sewing machine, wheelbarrow, bicycle, bus, etc.) (Crisis)	47
Sold more (non-productive) animals than usual (Stress)	22
Send members of the household to eat elsewhere (Stress)	8
Spent savings (Stress)	29
Borrowed money (Stress)	53
Sold the house or land (Emergency)	10
Removed children from school (Crisis)	5
Sold the last female animals (Emergency)	20
Mended/begging (Emergency)	4

Source: Personal work.

### 3.2. Discussion

The results (Table 6) show that the households have a good food consumption score of (99.8%) acceptable. The good level of food consumption is the result of a fairly good level of consumption of the different product groups that make up food consumption. Indeed, the results indicate that there is a good level of food consumption of the different product groups by all households. In this group, staple foods are consumed every day by this group of households, which also have a good consumption of animal protein. Only (0.2%) have a poor food score. These results corroborate with Komi [29] finding, showing that (84%) of households have an acceptable food consumption score in the Prefecture of Tône in Togo. Moreover, these results are contrary to those of previous studies, notably those by WFP (2015) [30] in Burundi on the food security monitoring system (60% acceptable, 30% borderline, 10% poor) and WFP (2018) [31] in Senegal on the rapid analysis of food security in the north (67.1% acceptable, 19% borderline, 13.9% poor). Furthermore, the results show that nine out of ten households (97.8%) are marginally food secure which means that the households are able to meet their essential food and non-food needs without resorting to atypical coping strategies. This could be explained by the good agricultural season of the year behind (2019-2020). Then, their family stocks were sufficient against only (2%) of those who are food secure and (0.2%) of those who are borderline food insecure, which shows that households have just adequate food consumption without resorting to irreversible coping strategies. These results are contrary to those of previous studies, notably by Komi (2017) [29] in Togo, who observed that the food situation and coping strategies to face food insecurity in the Prefecture of Tône, Togo (27.8%) of households were food secure, (42.6%) borderline food insecure, (26.0%) moderately food insecure, and (3.6%) severely food insecure. According to one of the precious studies by WFP (2015) [30] on the analysis of urban vulnerability in the cities of Antananarivo, Toamasina, and Toliara in Madagascar showed that (37.73%) of food secure, (43.88%) of borderline food secure, (18.39%) of moderately food insecure and 0% were severely food insecure.

Regarding households' food expenditure share, the results reveal that (100%) of households spent less than 50% on food. That means that most of the food consumed

by households was from their own production. The findings of this study are in agreement with the one from Samake (2020) [32] in Mali, which showed that (99%) of households spent less than 50% on food. These results were not confirmed by the findings obtained by Komi (2017) [29], which showed that (38.5%) of households spent on food, (and 27,8%) of them spent more than (75%) of their income on food in the Prefecture of Tône in Togo.

The food coping index counts the frequency and severity of behaviours that people engage in when they do not have enough food or behaviours that people engage in when they do not have enough food or money to buy food [33].

In order to improve their level of food consumption, (64.4%) of households resorted to food coping strategies. For example, (36%) of them borrowed money. Borrowing money and credit can minimize the ability of households to cope with food and non-food deficits during shocks. (31%) reduced the amount of food consumed by adults to feed children, (28%) reduced the number of meals per day. This shows the shortage of stocks and the difficulty of access to food in the household. (23%) use less popular and cheaper foods. (22%) limited the size of portions during meals, and (9%) of them went a whole day without eating. This indicates the economic vulnerability of households to cope with shocks. These results seem to contradict those of the WFP (2014) [25] Vulnerability, Food Security and Nutrition Analysis (VFSNA) in Senegal, which showed that (43%) consumed less preferred foods, (29%) borrowed food or sought help from a friend or relative, (30%) of households have limited the size of portions during meals, (22%) have reduced the number of meals per day, and (17%) have reduced adult consumption in favour of children and WFP (2017) [34] on the Joint Assessment Mission "Level of Socio-Economic Reintegration, Livelihoods and Food Security of Returnees and Host Communities in West and South-West Côte d'Ivoire". Which also showed that (59.5%) consumed fewer preferred foods (60.1%) borrowed food or asked for help from a friend or relative, (47.9%) of households limited the size of portions during meals, (38%) reduced the number of meals per day, and (62.6%) reduced consumption by adults in favour of children.

The results of the analysis showed that, of the different socio-economic characteristics of households considered in the analysis of food insecurity factors, only cows' ownership and work for cash have a statistically

significant association with household food security status. Although, there are differences observed with age, marital status of the head of household, household size, level of education, religion, farm size, bird ownership, and sheep ownership. These factors could not predict a household's food situation since their association with household food situation is only a chance effect (P-value of the Chi2 test).

If the use of food consumption-based strategies does not solve the food problems, households are forced to use livelihood-based strategies, such as emergency strategies adopted (64.4%), that affect the future capacity to produce and are more difficult to reverse. This involves begging; selling the last productive females; selling the house, the plot of land, or the field house. Crisis strategies (33.6%), directly affect future productivity. It is a matter of selling productive goods or means of transport (bicycle, wheelbarrow, etc.), reducing essential non-food expenditures such as education, health, and withdrawing children from school. Stress (1.8%) which capacity to cope with future shocks (selling household assets/goods, radio, furniture); borrowing money; spending savings; having sold more non-productive animals than usual). WFP (2018) [31], in its rapid survey of household food security in the city of Ndjamena, came up with contrary results, with (50%) of no strategy in the 3<sup>rd</sup> Arrondissement, (22.9%) stress in the 10<sup>th</sup> arrondissement, (13.3%) crisis in the 6<sup>th</sup> Arrondissement, and (14.3%) emergency in the 10<sup>th</sup> district. This situation conducts the households' to sell their precious livelihoods in order to cope with the periods of lack of food. These results do not corroborate those of the harmonized framework analysis of October 2016, which placed the prefecture of Tône in the pressure phase [35] showing that (27.8%) of households were under stress, (26%) were in crisis, and (3.6%) in an emergency.

## 4. Conclusion

This study is intended to be a snapshot of the food situation and coping strategies for food insecurity in the Koutiala and San districts. Although it has its limitations, as does any study, it has achieved its overall objective of contributing to a better understanding of the food situation and strategies of the local population of contributing to a better understanding of the food situation and household coping strategies for coping with food insecurity and resolving the problem of the lack of surveys or studies on food security in a recognized vulnerable area as Koutiala and San districts.

The study reveals that overall; more than four out of five households (99.8%) have good food consumption but cannot afford some non-essential food expenditures without resorting to inappropriate coping strategies.

The main factors of food security, are the increase in agricultural inputs price, the difficulty in food availability, increase of food price, rainfall variability, income reduction, debt payback, effects of natural disasters (drought, flood), and human insecurity. The recurrence of food insecurity in the Koutiala and San districts is the result of a number of structural and cyclical factors. The state of poverty experienced by households, the low level of access to basic social services and protection, the poor

modernization of agriculture and livestock systems, the demographic explosion, and the effects of climate change keep households in a permanently vulnerable situation. To cope with these shocks and food scarcity, households develop various coping strategies depending on their food consumption and livelihood opportunities offered by society, and the interventions of development programs and projects.

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