Food availability and accessibility indicator of performance of family farms in terms of food and nutritional security.

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Abstract

The performance of a farm is relative to its productive and economic and agro-ecological capacity. However, this performance of family farms contributes to the resilience of populations to food and nutrition crises and to the harmful effects of change. This study carried out in the regions of Maradi, Tahoua and Tillaberi aims to show that the possession of livestock is a performance indicator of family farms in terms of food and nutritional security. Based on surveys and measurements, the sample includes 486 heads of farms spread across 3 regions, 6 communes and 18 villages. The results of this study showed that the duration of stock is significantly different between the three regions (P-value=0.005), it is on average 2.61 ± 2.20 for the region of Maradi, 3.16 ± 2, 58 for the Tahoua region and 3.26 ± 2.69 for the Tillaberi region. As for the possessions of cattle (UBT), they are significantly different from one region to another (P-value=0.045), it is 4.36 ± 11.84 (Maradi), 3.02 ± 4.75 (Tahoua) and 3.73 ± 7.89 (Tahoua). But, goats are the most significant (P-value=0.000). The regions are characterized by a significantly food consumption score and confidence intervals [68,15; 75.32] for Maradi, [82.72; 90.30] for Maradi and [68.45; 75.14] for Tillaberi. These intervals shows the consumption score is acceptable. In fact, the share of food expenditure in total expenditure is ± 58.48 ± 30.85 (Maradi), 55.29 ± 32.34 (Tahoua) and 46.08 ± 29.69 (Tillaberi). Expenses are also significantly different between regions (P-value=0.001). As for food strategies, they are highly significant from one region to another (P-value=0.000). They are on average 5.10 ± 4.24 (Maradi), 4.8 ± 3.91 (Maradi) and 3.38 ± 3.34. Dietary diversity is highly significant and the intervals show a low diversity score. [02.56; 03.61] (Maradi), [02.95; 04.29] (Tahoua) and [02.33; 03.67](Tahoua). The correlation test gave a highly correlated UBT and shelf life; UBT and food consumption and UBT and dietary diversity. Camels had a great impact over the 12-month period and more, so goats correlated positively with acceptable food consumption.

Keywords: Family farm; Performance; Indicator; UBT; Resilience; Food and nutritional security; Climate change.

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Introduction

Agriculture's interest in food security in North Africa has increased following the surge in food prices and their continued volatility since late 2006. Food security requires that food is available, accessible and used appropriately. Farms play a key role in providing food availability, an important source of income to purchase food and food products with high nutritional value [1]. Indeed, food systems correspond to the set of operating rules, modes of organization, technologies and practices that determine the modes of consumption, production, processing, packaging, storage and distribution of goods food [2]. Thus, food production depends on factors such as the modes of exploitation and appropriation of land, the reproduction and selection of plant species, crop rotation, multiplication, management and exploitation of livestock. As a result, there is a large margin of overlap and correlation between the various components of the food system and farms [3]. In addition, the same body stipulates that food availability (stocks) expresses the performance of farms because they are expressed in quantity by the composition of supplies and in quality by the conversion of products into calories, proteins and lipids.

In Niger, food supplies are produced by the production of farms and national stocks constituted by national production and imports, the latter is used not only to prevent food crises but also to manage emergency situations [4]. However, owning livestock makes it possible to extend the life of stocks at the household level and to diversify the diet. The latter constitutes a strategy for household resilience to food and nutritional insecurity. In addition, local stocks are promoted as one of the first prevention strategies and responses to food and nutritional crises [3]. The women's granaries, local stocks are designed to extend the duration of stock and prevent malnutrition in children from 0 to 5 years old. Indeed, in some cases the origin of food crises does not reveal a shock but the process of impoverishment of rural households which has led to a crisis of access to food. Food stability is a guarantee of the availability and accessibility of food products. This is the cereal products markets in October trading products [5].

Food vulnerability indicators depend on farms because they are warning signs of a food crisis based on the results of the agro-pastoral campaign. They are also dependent on rainfall which determines the instability or stability of the food and nutritional situation [4]. As a corollary, many studies including, [6-8] have shown that organic manure alone or in combination with mineral manure improves farm performance by significantly increasing crop yields.

The increase in crop yields influences the productive and economic performance of family farms [8].

This study, based on surveys and measurements, aims to show the links between animal ownership (UBT) is a performance indicator of family farms in food and nutrition security.

This specifically involves: (i) analyzing food accessibility indicators, (ii) analyzing food availability indicators, (iii) distributing the indicators by region.

Materials and Methods

Study zone

The study was carried out in the regions of Maradi, Tahoua and Mardi. From an agro-ecological point of view, these three regions belong to the Sahelian strip located between latitudes 11040 and 16031 North and longitudes 3059 and 13040 East. This area covers 10% of the territory and receives an average of 300 to 700 mm of rain per year. The climate is tropical arid with a rainy season from June to September and a dry season from October to May. It is an agro-pastoral area whose annual rainfall is characterized by significant spatio-temporal and interannual variability and a general trend of isohyets sliding towards the south. These phenomena increase the risks of drought and desertification which have consequences on agro-sylvo-pastoral production (Figure 1). As for the minimum temperatures, they varied between 25008 in Maradi against 20.40 in Tahoua and 22,045 in Tillaberi and the maximums between 56028 on Tuesday, 48053 in Tahoua and 58073 in Tillaberi (Figure 2).

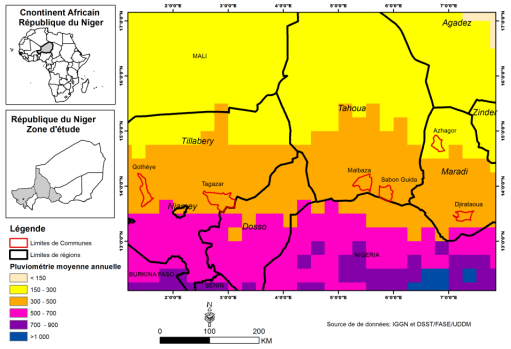

Figure 1. *Location of the study area.*

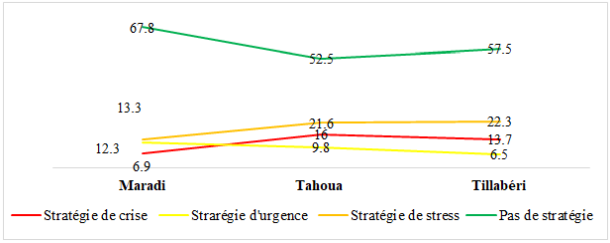

Figure 2. *Types of strategies according to the periods according to the regions.*

Methodology

The methodology includes: Data collection, data analysis and desk research.

Data collection methodology

Sampling and data collection: The target population of this study was that of the region of Maradi, Tahoua and Tillaberi spread over six (6) communes and eighteen (18) villages. It is a type of stratified sampling survey at two levels: the Primary Units (PU) are the villages and the Secondary Units (US) are the heads of family farms. The sampling frame for the selection of PUs consisted of the list of villages in the study area. A count was carried out in each sampled village in order to constitute the sampling frame for the US [9]. The determination of the sample size took into account the expected non-response rate and the cluster effect. Thus, the sample size of the primary units is 18 villages out of 90 villages, or 20%. In each village, an average of 27 farm managers per village was surveyed using a simple systematic selection whose algorithm is as follows: (1) numbering the farm managers from 1 to N; (2) calculate the pulling step p=N n; with: N=total number of farms and n=number of farms chosen; (3) random selection of a number between 1 and p (1 and p included). Let u1 be this number. This is the number of the first exploitation drawn. The other holdings are found by adding the step p to the last number drawn.

Collection of data: Conducted according to the SMART methodology, it is a rapid, standardized and simplified survey method with real-time data entry in the field. Smartphones (tablets) were used for data collection on the digital Open Data Kits system "ODK v1.15.1". Two data collection tools were used: a semi-interview guide for group interviews (focus group) and an interview guide for individual questionnaires. The measurements were taken at the level of household consumption and they converted from the local measurement to the conventional measurement (eg: boot to the 100 kg bag and tia to kg). These measures vary from region to region.

Data analysis methodology: The data were analyzed using SPSS.20 and Munitab.20 software and excel spreadsheet. A descriptive and multivariate statistical analysis was first carried out to determine the main characteristics of the food indicators for each region (mean, standard deviation, maximum, minimum) and the probabilities (P-value) made it possible to determine the significance of the different variables. The confidence intervals made it possible to frame the actual values sought. An ANOVA correlation test was done to determine the link between UBT and the various food and nutrition security indicators [10].

Documentary research

Definition and method of calculation of the concepts used:

The duration of food stocks (availability at the farm level): Food availability is the production of the farm available to households, resulting from domestic production in all its forms, commercial imports and food aid. These availabilities can be aggregated at the level of a region, country, district or community. However, it should be noted that availability can be limited by a number of socioeconomic factors, namely: the risk of physical attack, isolation, food prices, etc. The coverage rate represents the number of months during which the household can feed and heal itself (that is, just ensure the reproduction of the labor force) with the production of the farm.

Analysis of the duration of available food stocks=Criteria for covering household food needs by the production of the farm: Coverage rate (TC).

Ownership of livestock expressed in tropical units (accessibility): The method involves determining the number of animals owned by a farm in a single unit, called the Tropical Livestock Unit (TLU). Thus, coefficients are assigned to the different species according to their average value and according to the term of the exchange (animals for cereals) to compare them with a common unit, namely camels.

UBT=Number of cattle × 0.8+Number of sheep × 0.1+Number of goats × 0.1+Number of camels × 1+Number of animals × 0.5+Number of horses × 0.5

The proportion of food expenditure over total expenditure (accessibility): One of the sections of the household questionnaire collects data on the farm manager's expenses as well as self-consumption during the last thirty days preceding the survey. The information is obtained on a statement from the chef which estimates the amounts spent on the various products which can be classified as food and non-food [11]. These data make it possible to calculate household food expenditure including self-consumption, food expenditure in cash, which does not take into account self-consumption as well as the proportion of food expenditure in overall expenditure.

Food expenditure share=Total expenditure-food expenditure × 100

The food consumption score (accessibility and use): Calculation of the food consumption score (Food Consomption score crosstabulation) This is an indicator that measures the quality of household food. It helps to understand the accessibility and use of food by households. It is calculated based on the dietary diversity, frequency and nutritional importance of each of the eight food groups selected. Its following formula: Score=∑_(i=1)^8 [Pi × N] where i: represents the eight selected food groups Pi: represents the weight of group i ($0.5 \leq Pi \leq 4$) and Ni: represents the number of days of consumption relating to each group of foods ($Ni \leq 7$ days). The different intervals of the score are as follows: (i) if the score is less than 28, then household food consumption is poor, (ii) if the score is between 28.5 and 42, food consumption is intermediate, (iii) if the score is greater than or equal to 42.5, then food consumption is acceptable.

Food diversity score or weekly dietary (accessibility and use): The dietary diversity score indicates the quality of food consumption, and to a lesser extent, the quantity of food. It provides information on the number of different food groups consumed by the entire household during a given reference period (last 24 hours or last 7 days). The HDDS score is between 0 and 12, with reference to the different food groups: cereals, roots and tubers, vegetables, fruits, meat/poultry/offal, eggs, fish and shellfish, legumes/pod vegetables/nuts, milks and dairy products, oils/fats, sugars, miscellaneous (tea, coffee, condiments, etc.). If the dietary diversity score is between 1 to 3 foods is said to be low dietary diversity, if it includes 4 foods=medium dietary diversity and if it is between 5 to 8 foods with high dietary diversity (Tables 1 and 2).

Diversity score=a cereal × cereal+a legume × legume+a vegetables × vegetables+a fruit × fruit+a animal × animal+a sugar × sugar+a milk × milk+a oil × oil.

Table 1. *Weighting of the different food groups. Weighting of the different food groups.*

Food groups	Food	Weighting
Cereals and tubers	Fresh corn, dry corn, rice, sorghum, tubers	2
Legumes	Legumes (beans, cowpeas)	3

Vegetables	Vegetables and leaves	1
Fruits	Fruits	1
Animal products	Fresh dried or smoked fish, poultry, Shrimp, fresh or dried meat, eggs	4
Sugar	Sugar	0,5
Milk	Dairy products	4
Oil	Oil	0,5

Source: PAM, 20015

Table 2. *Weighting of strategies.*

Number	Strategies	Weighting
1	Consumption of less preferred foods	1
2	Decrease in daily ration	1
3	Foodstuff	2
4	Purchase of food on credit	2
5	Demand for food for children	2
6	Reduction of the daily ration of adults for the benefit of children	2
7	Decrease in the number of meals eaten per day	2
8	Seed consumption	3
9	Food shortage consumption	4
10	Use of begging from a household member	4
11	Go all day without eating	4

Source: PAM, 20015

The survival strategy index (accessibility): Household coping strategies are an essential component of analyzes of food security outcomes. They provide information on the severity and extent of the behaviors that households adopt when faced with a food deficit and/or the financial means to access food. The CSI tracks changes in household behavior and indicates the degree of food insecurity compared over time or from a threshold or from a reference threshold (developed by MAXWELL). The indicator provides information on the use (as well as the frequency) of behaviors or strategies (i.e. reducing the amount of food during meals) during the last 7 days, if the household ran out of food or money to buy food [12].

Algorithm: CSI=strategy 1 (frequency × severity)+strategy 2 (frequency × severity)+strategy 3 (frequency × severity)+…;

Results

Duration of farm stocks

The results show that the probability for all three regions is 0.005, it is on average 3 months for the three regions but the duration of stock between 3 to 6 months is 0.041. Means and confidence intervals differ between regions and stock duration classes (Table 3).

P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Table 3. *Statistical analysis of the duration of stock according to the regions.*

Month	Region	Minimum	Mean ± Standard deviation	95% CI	Maximum	P-value
≤ 3	Maradi	0	1.68a ± 1.05	[1.41; 01.95]	3	0.576
	Tahoua	0	1.70a ± 1.19	[1.39; 02.00]	3	
	Tillaberi	0	1.86a ± 0.97	[1.61; 02.12]	3	
03-Jun	Maradi	4	4.31c ± 0.48	[3.91; 04.72]	5	0.041
	Tahoua	4	4.80b ± 0.93	[4.29; 05.31]	6	
	Tillaberi	4	5.00a ± 0.85	[4.65; 05.34]	6	
06-Sep	Maradi	7	7.00 ± *	[02.03; 11.97]	7	0.83
	Tahoua	7	7.67a ± 1.15	[04.80; 10.53]	9	
	Tillaberi	7	7.00 ± *	[02.03; 11.97]	7	
≤ 12	Maradi	10	10.6a ± 1.15	[09.53; 11.81]	12	0.222
	Tahoua	12	12a ± 00.00	[10.86; 13.14]	12	
	Tillaberi	10	11.40a ± 0.89	[10.52; 12.28]	12	
Together	Maradi	0	2.61c ± 2.20	[02.05; 03.17]	12	0.005
	Tahoua	0	3.16b ± 2.58	[02.35; 03.62]	12	
	Tillaberi	0	3.26a ± 2.69	[02.64; 03.67]	12	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Ownership of livestock expressed in Tropical Units (TLU)

The UBT analysis showed that livestock ownership is on average 4 UBT for the Maradi region against 3 UBT for the Tahoua and Tillaberi regions. The differences are more important in the region of Maradi (11.84). The probability is 0.045 and goats have a probability of 0.000. Ownership of livestock differs according to the species, the regions also the confidence intervals differ according to the species (Table 4).

P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Food expenses of the family farm

Food expenses have a probability of 0.000 as well as expenses related to animal and plant productions. The share of food expenditure in the Maradi region represents on average 58.48% of total expenditure against 55.29% and 46.08% respectively in the regions of Tahoua and Tillaberi (Table 5). The probability of food expenditure is 0.001. There is a significant difference between the three regions [13].

Food and nutrition insecurity resilience strategies

Table 6 illustrates the number of meals taken at the time of the surveys and the number usually taken during the period, the results show that on average 2 meals are worse regardless of the period. The number of meals and the strategies have respective probabilities of 0.007; 0.016 and 0.000. But strategies less than 10 have a probability of 0.004. There is a significant difference between regions. Within the number of strategies are included the types of strategies [14].

Food consumption score

Consumption is significantly different between regions P-value=0.000. The score for poor consumption and acceptable food consumption have probabilities of 0.050 and 0.000. The consumption averages for the three regions are within the different confidence intervals (Table 7).

Dietary diversity score

Dietary diversity is on average 3 groups for all three regions. The probability of low dietary diversity is 0.801 and that of high dietary diversity is 0.273. The maxima are 7 groups for the Tillaberi region and 6 groups for the Tahoua and Maradi regions (Table 8).

Table 4. *Statistical analysis of UBT indicators by region.*

Variables	Region	Minimum	Mean ± Standard deviation	95% CI	Maximum	P-value
Cattle	Maradi	0	1.83a ± 6.17	[1.03; 2.62]	56	0.11
	Tahoua	0	1.21a ± 2.47	[0.37; 2.05]	20	
	Tillaberi	0	2.43a ± 5.11	[1.66: 3.20]	41.6	
Sheep	Maradi	0	0.14c ± 0.95	[0.29; 0.54]	8	0.2
	Tahoua	0	0.44a ± 0.92	[0.31; 0.58]	7	
	Tillaberi	0	0.29b ± 0.33	[0.17; 0.42]	1.5	
Goats	Maradi	0	0.61a ± 0.78	[0.50; 0.72]	5	<0.000 ***
	Tahoua	0	0.46b ± 0.57	[0.35; 0.57]	3	
	Tillaberi	0	0.27c ± 0.60	[0.17; 0.38]	4	
Asin	Maradi	0	0.83a ± 2.08	[0.53; 1.13]	20	0.23
	Tahoua	0	0.45a ± 0.93	[0.13; 0.77]	8	
	Tillaberi	0	0.61a ± 2.16	[0.32; 0.90]	18	
Equine	Maradi	0	0.41a ± 1.04	[0.26; 0.56]	10	0.3
	Tahoua	0	0.22a ± 0.41	[0.06; 0.38]	4	
	Tillaberi	0	0.31a ± 1.08	[0.16; 0.45]	9	
Camelin	Maradi	0	0.65a ± 3.69	[0.20; 1.03]	40	0.17
	Tahoua	0	0.44a ± 3.19	[-0.03; 0.92]	35	
	Tillaberi	0	0.06a ± 0.39	[-0.39; 0.50]	4	
Together	Maradi	0	4.36a ± 11.84	[2.93; 5.77]	96.5	0.045
	Tahoua	0	3.02a ± 4.75	[1.52; 4.53]	38.2	
	Tillaberi	0	3.73a ± 7.89	[2.37; 5.11]	67.1	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Table 5. *Statistical analysis of the expenditure of family farms and the share of food expenditure in total expenditure.*

Variables	Region	Minimum	Mean ± Standard deviation	95% CI	Maximum	P-value
Food expenditure	Maradi	2500	75607c ± 74163	[62635; 88578]	725000	<0,000
	Tahoua	0	118510a ± 96570	[104093;13292]	722500	
	Tillaberi	5750	91046b ± 70195	[78031;104062]	386000	
Non-food expenditure	Maradi	400	84963a ± 167766	[60911;109014]	1591100	0,900
	Tahoua	0	85452a ± 182128	[60011;110893]	1968700	
	Tillaberi	500	91839a ± 114686	[69350;114328]	712700	
Food debt	Maradi	50	66143a ± 97055	[14324;117963]	341000	0,093
	Tahoua	100	52760c±61114	[11077; 94444]	200400	
	Tillaberi	200	63951b ± 94014	[29578; 98324]	410000	
Expenses related to animal and plant production	Maradi	1500	72786b ± 101427	[40576;104995]	557000	<0,000
	Tahoua	100	1886531a ± 262118	[156468;220593]	2302500	
	Tillaberi	900	78710c ± 95141	[47075; 110344]	426800	
Share of food expenditure in total expenditure	Maradi	0	58,48a ± 30,85	[53.69; 63.28]	98.1	<0,001
	Tahoua	0	55,29b ± 32,34	[50.22; 60.36]	99.43	
	Tillaberi	0	46,08c ± 29,69	[41.60; 50.56]	99	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Table 6. *Statistical analysis of food strategy indicators.*

Strategies	Region	Minimum	Mean ± Standard deviation	95% CI	Maximum	P-value
Number of meals	Maradi	1	2.18c ± 0.69	[2.07; 2.29]	4	<0.007
	Tahoua	1	2.40a ± 0.57	[2.29; 2.52]	3	
	Tillaberi	1	2.37b ± 0.74	[2.27; 2.47]	5	
Number of meals usually at the same time	Maradi	1	2.14b ± 0.66	[2.03; 2.24]	3	<0.016
	Tahoua	1	2.33b ± 0.61	[2.11; 2.44]	3	
	Tillaberi	1	2.33a ± 0.76	[2.23; 2.43]	5	
Less than 10	Maradi	0	3.31c ± 2.69	[2.85; 3.77]	9	<0.004
	Tahoua	0	3.59b ± 2.94	[3.11; 4.06]	9	
	Tillaberi	0	2.60a ± 2.33	[2.19; 3.00]	9	
Egal à 10	Maradi	10	10 ± 0	*	10	*
	Tahoua	10	10 ± 0	*	10	
	Tillaberi	10	10 ± 0	*	10	
Supérieur à 10	Maradi	11	12.03a ± 1.12	[11.60; 12.47]	13	<0.53
	Tahoua	11	11.62c ± 0.96	[11.04; 12.21]	13	
	Tillaberi		11.89b ± 1.62	[11.11; 12.60]	12	
Ensemble	Maradi	0	5.1a ± 4.24	[04.51; 05.69]	15	<0.000
	Tahoua	0	4.8b ± 3.91	[04.22; 05.47]	14	
	Tillaberi	0	3.38c ± 3.34	[02.82; 03.93]	16	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions, * means that statistically it does not exist.

Table 7. *Statistical analysis of the food consumption score by region.*

Variable	Region	Minimum	Mean ± Standard deviation	Maximum	95% CI	P-value
Poor	Maradi	15	24.40a ± 5.42	28	[17.62; 31.18]	<0.050
	Tahoua	2	13.00c ± 7.58	18.5	[5.42; 20.58]	
	Tillaberi	4	15.50b ± 7.66	28	[10.71; 20.29]	
Intermediate	Maradi	30	37.06a ± 4.26	41.5	[35.10; 39.03]	0.238
	Tahoua	39.5	40.75a ± 1.77	42	[35.20; 46.30]	
	Tillaberi	29	35.94a ± 3.53	41	[34.04; 46.30]	
Acceptable	Maradi	43.5	77.43a ± 17.57	112	[74.43; 80.42]	<0,000
	Tahoua	52	89.32 ± 14.74	112	[85.68; 91.70]	
	Tillaberi	43.5	79.31 ± 19.55	112	[76.48; 82.14]	
Together	Maradi	15	71.73 ± 22.14	112	[68.15; 75.32]	<0.000
	Tahoua	2	86.51 ± 19.96	112	[82.72; 90.30]	
	Tillaberi	4	71.80 ± 25.93	112	[68.45; 75.14]	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions.

Table 8. *Statistical analysis of the dietary diversity score of the three regions.*

Food diversity	Region	Minimum	Mean ± Standard deviation	Maximum	95% CI	P-value
Low	Maradi	2	2.00a ± 0.74	3	[01.58 ; 02.42]	0.801
	Tahoua	1	2.1a ± 1.20	3	[01.52; 02.68]	
	Tillaberi	1	2.21a ± 0.89	3	[01.72 ; 02.71]	
Average	Maradi	4	4.00 ± 0.00	4	*	*
	Tahoua	400	4.00 ± 0.00	4	*	
	Tillaberi	5	4.00a ± 0.00	4	*	
Strong	Maradi	5	5.17a ± 0.41	6	[04.64;05.70]	<0.273
	Tahoua	5	6.00a ± 0.18	6	[04.91;05.83]	
	Tillaberi	5	6.68a ± 0.14	7	[05.08;06.92]	
Together	Maradi	1	3.09b ± 1.42	6	[02.56;03.61]	<0.048
	Tahoua	1	3.62a ± 1.77	6	[02.95;04.29]	
	Tillaberi	1	3.00c ± 0.32	7	[02.33;03.67]	

Note: P ≤ 0.05=the probability is significant, P>0.05=the probability is not significant. The different letters mean that there is a significant difference between the three regions and regions. The same letters mean that there is no significant difference between the three regions, * means that statistically it does not exist.

Table 9. *Relationship between food availability, accessibility and use.*

Correlation	Stock duration	UBT	Part_dep_al.	Strat_al.	Score_cons_al.	Score_div.al
Stock duration	1					
UBT	0.645	1				
	(0.000)***					
Part_dep_al.	-0.027	-0.773	1			
	-0.558	(0.009)*				
Strat_al.	-0.624	-0.883	-0.527	1		
	(0.000)***	(0.003)***	(0.003)*			
Score_cons_al.	0.99	0.103	0.055	-1	1	1
	(0.001)***	(0.002)***	-0.24	(0.000)*		
Score_div_al.	0.98	0.561	-1	-0.775	0.617	1
	-0.12	(0.010)**	(0.000)*	(0.005)*	(0.000)***	

Note: If R2 ≥ 0.5 and P-value therefore the correlation is highly significant, *** means that the correlation is highly significant, R=determines the correlation coefficient

Characteristics of farms by food availability and accessibility

The ACP notes that the first two axes concentrate 100% of the total variance. Axis 1 explains 57.7% and Axis 2 explains 42.30%. The interpretation of the factorial plan shows that the family farms that there is no UBT in the Tahoua region [15]. The shelf life is greater than or equal to 12 months but consumption is low. Farm managers practice crisis strategies and strategy strategies while food expenditure is less than 25% taking into account the optimal duration of the food stock (Figure 3).

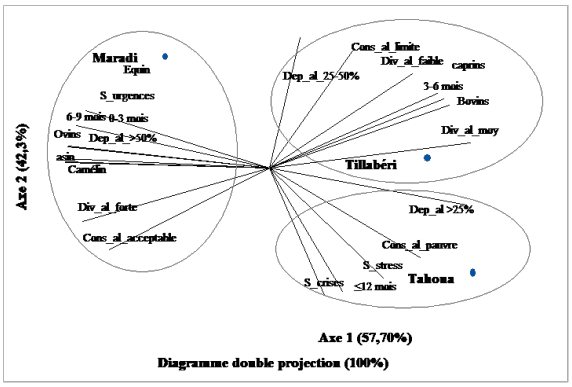

Figure 3. *Distribution of family farms according to food availability and accessibility.*

Relationship between availability, accessibility and food use

The results of Table 9 show that there is a significantly positive correlation between the duration of stock and the UBT (R2=0.645; P=0.000) and between the duration of stock and the food consumption score (R2=0.990 and P=0.001). But the correlations between stocking time and feeding strategies are significantly negative (R2=-0.64 and P=0.000). There is also a significantly negative correlation between the duration of stock and the share of food expenditure in total expenditure (R2=0.990 and P=0.000). Also UBT positively correlated with food consumption and dietary diversity. Also, UBT negatively correlated with food strategies and food expenditure. The table also shows that food consumption and diversity have a significantly negative correlation with food expenditure and dietary strategies. Finally, there is no correlation between stock time and dietary diversity, but the latter is significantly correlated with dietary diversity [16].

Discussion

The results of this study showed that the duration of stock and the possession of animals are performance indicators of family farms in terms of safety and nutrition. These influence the food consumption and diversity score. In addition, farms without UBT have a poor consumption score and dietary diversity is not determined. UBT is a performance indicator of family farms for food and nutrition security. It influences the productive and economic performance of family farms. These results also corroborate those [17] who showed that the income from the sale of animals is used to pay for cereals and vice versa; and that this practice constitutes an endogenous strategy for adaptation to food insecurity. Farms with camels have a shelf life of at least 12 months but camels have a greater influence on food consumption and dietary diversity. Indeed, food availability and diversity is a guarantee of good nutrition [18]. Studies by Pauze confirm that possession of farm animals has been associated with better food access. In addition, this food availability is the consequence of a fertile farm because the association of animals on farms allows crops to benefit from organic manure and increases agricultural production. This practice has long been popularized to countries as one of the best agroforestry practices. Indeed, agriculture-livestock-forestry integration can be seen as a peasant strategy of adaptation and/or mitigation in the face of socio-environmental risks. Indeed, this integration allows farmers to diversify their activities, reduce risks such as food insecurity and improve soil fertility [19]. Some authors, agriculture – livestock integration takes the form of transfer of manure from animals to the fields, and in the other direction of use of crop residues for fodder and animal feed [20]. Moreover, the level of production, the types of crops applied, the quality and quantity of meals consumed are one of the factors that explain chronic malnutrition in the Sahel [21].

This study also showed that food strategies have a relation on the duration of stock, UBT, the share of food expenditure and consumption. However, the strategies practiced by farm managers are survival strategies and are practiced only in crisis, emergency or stress situations, they are responses at the moment of the fact. Positive strategies aim to strengthen the resilience of populations to food and nutrition insecurity and to the adverse effects of climate change. For Tahirou (2013), local stocks, poultry farming and small ruminant fattening are positive strategies. Environmental conservation and restoration works have been significant on millet production. Thus, stone bunds, half-moons and zaï are long-term preventive strategies that affect agricultural production [22].

Finally, the results showed that food diversity is proportional to food consumption; these results are similar to those of [23], who assessed the dietary diversity score based on household food consumption, the same author confirms that a diversified diet is necessary to provide the body with l essential nutrients it needs for its functioning [23]. Food consumption was evaluated from dietary diversity and the latter was also identified from food consumption. The latter concludes that consumption and dietary diversity differ according to the seasons. In addition, is a factor in the success of breastfeeding, in fact, acceptable food consumption during the breastfeeding period is an important factor for the optimal health of women and their children [24].

Conclusion

Availability and accessibility are among the performance factors of family farms in food and nutrition security. Animals, particularly goats and camels, contribute to the maintenance of these two components of food and nutritional security. However, the short duration of the stock and the unavailability of animals on farms are causes of recurrent food crises and chronic malnutrition in the Sahel and particularly in Niger. The practice of animal husbandry is undoubtedly the engine of economic growth, food security and environmental protection in sub-Saharan Africa. The sustainable intensification of livestock production will bring significant benefits for food security, incomes, trade, smallholder competitiveness and ecosystem services. These benefits must be fully appreciated at this time when farmers face challenges. Investments in livestock production, in particular poultry and goats, contribute to the sector's sustainable development. The reconstitution of the herd more particularly the goats and the stocks of proximity for the women are alternatives to the problems of food and nutritional crises and to climate resilience.

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