**Household Dietary Profile, Diversity, and Food Security in the Grands-Ponts Region of Côte d’Ivoire**

**ABSTRACT**

**Objectives:** This study aimed to assess the dietary habits, food diversity, and nutritional security of households in this region.

**Study Design:** The Ivorian population is facing growing challenges related to food security, within a context marked by economic, climatic, and health crises. The departments of Dabou, Grand-Lahou, and Jacqueville, located in the Grand-Ponts region, are no exception.

**Study Location and Duration:** Nangui Abrogoua University, the departments of Dabou, Grand-Lahou, and Jacqueville, between July 3 and December 3, 2023.

**Methodology:** A cross-sectional survey was conducted with 1,059 households, using structured questionnaires to collect data on sociodemographic profiles, dietary practices, and food security indicators, including the Household Dietary Diversity Score (HDDS) and the Simplified Coping Strategies Index (rCSI).

**Results:** The results show that 75% of households consume three meals a day, but their diet remains monotonous, dominated by attiéké. Fish is the main source of protein, while dairy products, eggs, and fruits are under-consumed. Approximately 27% of households are food insecure, and only 10% enjoy food security. These findings reveal socio-economic constraints and limited dietary diversity.

**Conclusion:** This study highlights the need to promote dietary diversification and strengthen food security programs. Targeted actions in nutritional education and better access to diverse foods should be considered to sustainably improve the situation.

***Keywords:*** *Dietary diversity, Food insecurity, Eating habits, Households, Côte d’Ivoire.*

**INTRODUCTION**

Nutrition plays a central role in the health and well-being of populations. It is a determining factor in growth, development, and disease prevention. Indeed, a varied and balanced diet is essential at every stage of life, contributing to the reduction of non-communicable diseases such as diabetes, cardiovascular diseases, and certain cancers. In response to global food challenges, the World Health Organization (WHO) has developed strategies to improve eating habits and enhance food security for populations **[1]**.

To assess dietary quality, the Dietary Diversity Score (DDS) has emerged as a relevant indicator. This score reflects not only eating habits but also access to different food groups **[2]**. However, in sub-Saharan Africa, food insecurity remains a major challenge, characterized by low dietary diversity. Energy-dense foods such as cereals and tubers often predominate at the expense of foods rich in essential micronutrients **[3]**.

In Côte d’Ivoire, household diets are predominantly composed of cereals (38%), roots, tubers, and legumes (32%), as well as oilseeds (14%) **[4]**. Despite the country’s diverse agricultural production, eating habits remain poorly diversified, favoring energy-dense foods over fruits, vegetables, and animal-based products **[5]**. This situation is exacerbated in rural and peri-urban areas, where economic and cultural constraints limit access to a balanced diet.

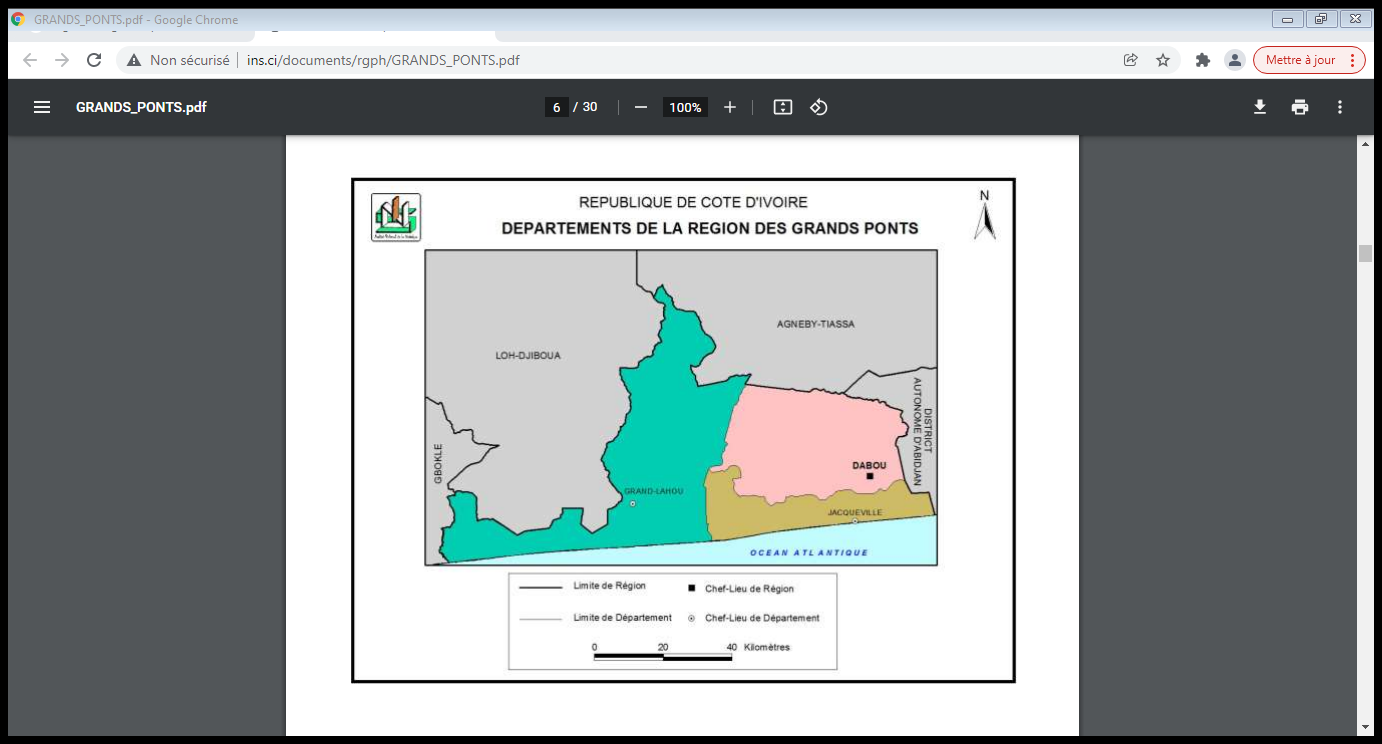
The Grands-Ponts region, located in southern Côte d’Ivoire, is representative of the nutritional challenges faced by Ivorian households. This region, rich in agricultural resources, experiences significant disparities in food security. Households primarily consume foods from their own production, often limited to a few food groups. This practice restricts their intake of essential nutrients, increasing the risks of malnutrition and other nutrition-related diseases. However, the specific causes of this low dietary diversity and their precise impacts on the nutritional security of different social groups remain under-documented.

Furthermore, insufficient dietary diversity can have severe health consequences, particularly for vulnerable groups such as children and pregnant women. Micronutrient deficiencies, including iron, vitamin A, and zinc, are common and compromise the physical and cognitive development of populations **[6]**. A comprehensive understanding of local eating habits is therefore essential to propose tailored interventions. It will also help update existing data in a context where eating habits are evolving due to economic, climatic, or health crises.

In this context, this study was initiated to evaluate the eating habits and dietary diversity of households in the Grands-Ponts region. It aims to provide essential data to guide nutrition policies and programs in Côte d’Ivoire, identifying improvement levers tailored to local specificities.

1. **MATERIALS AND METHODS**
2. **Study Area**

This study was conducted in the Grands-Ponts region (Figure 1), located in Côte d'Ivoire, with Dabou as the capital, 53 kilometers from Abidjan, the economic capital. The study area covers the departments of Jacqueville (72,993 inhabitants), Dabou (192,987 inhabitants), and Grand-Lahou (196,149 inhabitants), according to the General Population and Housing Census **[7]**.



**Fig. 1.** Map of the Grands-Ponts Region **[7]**.

1. **Study Type, Period, and Population**

The study is cross-sectional, descriptive, and analytical in nature, using a mixed-methods approach to collect both quantitative and qualitative data. It was conducted over a period of six months, from July 3 to December 3, 2023, involving 1,059 households residing in the Grands-Ponts region.

1. **Sampling**

The sample size was calculated to achieve a 95% confidence level, using the WHO's probabilistic method **[8]**. This estimation resulted in a total of 1,059 households, evenly distributed across the departments of Dabou, Jacqueville, and Grand-Lahou, with 353 households surveyed in each department. Households were selected using the Epi method **[9]**, adapted for emergency situations, ensuring an equal probability of selection for all households.

1. **Tools and Data Collection**

A survey form was designed to ensure the systematic collection of data. This questionnaire was developed based on the data collection tools recommended by the FAO for calculating the Household Dietary Diversity Score (HDDS) and the Reduced Coping Strategies Index (rCSI) **[10]**; **[11]**. Once finalized, the questionnaire was integrated into the mobile data collection platform KoBoToolbox **[12]**, with a dedicated server created for the study.

Data collection took place simultaneously across the three departments of the Grands-Ponts region, from July 3 to December 3, 2023. Regarding the rCSI, a seven-day recall was conducted with households. This recall focused on the five main coping strategies defined in the literature **[10]**; **[13]**; **[14]**. The rCSI was calculated by summing the scores assigned to each strategy, where the score corresponds to the frequency of use of the strategy multiplied by its universal weight **[10]**; **[15]**; **[13]**. Households were then classified according to their level of food security:

* rCSI < 5: Food security phase
* 5 ≤ rCSI < 20: Marginal food security phase
* rCSI ≥ 20: Food insecurity phase

As for the Household Dietary Diversity Score (HDDS), a 24-hour recall was conducted to document the foods consumed by households. This score is a proxy measure of households' access to a varied diet. It is based on the consumption of 12 food groups defined by the WFP **[16]**; **[17]**; **[18]**; **[19]**: (i) Cereals, (ii) Fish and seafood, (iii) Roots and tubers, (iv) Legumes/nuts, (v) Vegetables, (vi) Milk and dairy products, (vii) Fruits, (viii) Oils/fats, (ix) Meat/poultry/organ meats, (x) Sugar/honey, (xi) Eggs, and (xii) Miscellaneous foods.

1. **Statistical Processing and Analysis**

The collected data were entered into Microsoft Excel 2013, then exported and analyzed using SPSS version 27.0. Qualitative variables were expressed as percentages with one decimal place. Statistical comparisons of variables between the departments of Dabou, Jacqueville, and Grand-Lahou were performed using the Chi-square (χ²) test. This test helped identify significant differences in dietary patterns between these departments. Particular attention was given to statistical differences at a significance level of 5%.

1. **Ethical Considerations**

Approval for this study was obtained from the National Committee for Ethics in Life and Health Sciences (CNESVS) of Côte d’Ivoire (Ref.: 249-23/MSHPCMU/CNESVS-Km). Informed consent was obtained from participants after ensuring them of the anonymity and confidentiality of the collected data.

1. **RESULTS AND DISCUSSION**
2. **Resutats**
   1. **Sociodemographic Profiles of Households**

The sociodemographic characteristics of the surveyed population are presented in Table I. Household heads were composed of 50.7% men and 49.3% women. The predominant age group was 26 to 55 years, comprising 63.2% of the participants. Regarding marital status, 69.9% of respondents were single, 25.1% were married, and 5.0% were widowed.

In terms of education, 22.6% of respondents were illiterate, 26.8% had a primary education, 41.9% had secondary education, and 8.7% had higher education. Professionally, 44.9% were engaged in liberal professions, while 28.0% were housewives, 16.3% were unemployed or inactive, and 10.8% were salaried workers. Household size mostly ranged from 1 to 5 people (58.5%) or 6 to 10 people (30.7%). Finally, a majority of participants (75.8%) reported a household income of less than 60,000 CFA francs.

* 1. **Number of Meals Consumed per Day**

Figure 2 illustrates the number of meals consumed daily by households in the Grands-Ponts region. The majority of adults consumed three meals per day, with proportions of 59.49% in Dabou, 72.44% in Jacqueville, and 74.86% in Grand-Lahou. However, a notable proportion of adults limited themselves to two meals per day, accounting for 36.26% in Dabou, 24.15% in Jacqueville, and 23.45% in Grand-Lahou. Finally, only 0.28% and 0.57% of participants reported consuming four meals daily.

**Fig. 2.** Number of Meals Consumed by Households in the Grands-Ponts Region

0.57

**Table I.** Sociodemographic Characteristics of the Grands-Ponts Population

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Dabou Department | | Jacqueville Department | | Grand Lahou Department | | Total | |
| Effective | % | Effective | % | Effective | % | Effective | % |
| Sex | Male | 177 | 50.1 | 179 | 50.3 | 176 | 50.3 | 532 | 50.2 |
| Female | 176 | 49.9 | 177 | 49.7 | 174 | 49.7 | 527 | 49.8 |
| Age | 18-25 years old | 77 | 21.8 | 95 | 26.7 | 108 | 30.9 | 280 | 26.4 |
| 26-55 years old | 223 | 63.2 | 227 | 63.8 | 219 | 62.6 | 669 | 63.2 |
| 56-75 years old | 48 | 13.6 | 33 | 9.3 | 23 | 6.6 | 104 | 9.8 |
| 75 years and over | 5 | 1.4 | 1 | 0.3 | 0 | 0.0 | 6 | 0.6 |
| Level of study | Not in school | 84 | 23.8 | 61 | 17.1 | 94 | 26.9 | 239 | 22.6 |
| Primary | 93 | 26.3 | 103 | 28.9 | 88 | 25.1 | 284 | 26.8 |
| Secondary | 137 | 38.8 | 170 | 47.8 | 137 | 39.1 | 444 | 41.9 |
| Superior | 39 | 11.0 | 22 | 6.2 | 31 | 8.9 | 92 | 8.7 |
| Occupation | Unemployed-inactive  Liberal profession | 53 | 15.0 | 59 | 16.6 | 61 | 17.4 | 173 | 16.3 |
| 168 | 47.5 | 160 | 45 | 148 | 41.5 | 476 | 44.9 |
| Housewife | 91 | 25.8 | 96 | 27 | 109 | 31.1 | 296 | 28 |
| Employee | 41 | 11.6 | 38 | 11.3 | 35 | 10 | 114 | 10.8 |
| Marital status | Bride | 84 | 23.8 | 77 | 21.6 | 105 | 30.0 | 266 | 25.1 |
| Bachelor | 244 | 69.1 | 263 | 73.9 | 233 | 66.6 | 740 | 69.9 |
| Widower | 25 | 7.1 | 16 | 4.5 | 12 | 3.4 | 53 | 5.0 |
| Household size | 1-5 | 189 | 53.5 | 211 | 59.3 | 220 | 62.9 | 620 | 58.5 |
| 6-10 | 120 | 34.0 | 103 | 28.9 | 102 | 29.1 | 325 | 30.7 |
| 11-15 | 44 | 12.5 | 42 | 11.8 | 28 | 8.0 | 114 | 10.8 |
| Household income | < 60,000 | 283 | 80.2 | 225 | 63.2 | 295 | 84.3 | 803 | 75.8 |
| 60,001-120,000 | 52 | 14.7 | 82 | 23.0 | 41 | 11.7 | 175 | 16.5 |
| 120,001-240,000 | 16 | 4.5 | 48 | 13.5 | 13 | 3.7 | 77 | 7.3 |
| 240,001-300,000 | 2 | 0.6 | 1 | 0.3 | 1 | 0.3 | 4 |  |

* 1. **Foods Consumed During the Day**

figure (3) presents the types of foods consumed at different meals of the day. Attiéké emerged as the main carbohydrate source, consumed at breakfast, lunch, and dinner. The recorded proportions were 54.6%, 56.57%, and 59.34% in Dabou, 50.24%, 54.93%, and 60.97% in Grand-Lahou, and 50%, 50.3%, and 66.56% in Jacqueville. Secondary alternatives included rice, placali/cabato, and foutou/foufou, which remain integrated into local eating habits.

Regarding sauces, clear/vegetable sauce and palm nut sauce are consumed throughout the day, regardless of the meal. The clear/vegetable sauce was the most popular, particularly at lunch, where it appeared in more than 60% of meals in all locations. In contrast, palm nut and eggplant sauces were consumed in about 20% of meals.

As for protein foods, fish was the most frequently consumed source, closely followed by meat, which constitutes another significant contribution to the households' protein intake.

**Fig. 3.** Foods Consumed at Different Meals by the Grands-Ponts Population

* 1. **Household Dietary Diversity Score (HDDS)**

**Figure (3)** illustrates the Household Dietary Diversity Scores (HDDS) across the surveyed departments. The results show that a high score is most frequently observed in Grand-Lahou (47.3%), followed by Jacqueville (46.7%) and Dabou (36.8%). The medium score predominates in Dabou (42.5%), followed by Grand-Lahou (38.8%) and Jacqueville (37.7%). The low score is primarily recorded in Dabou (20.7%), compared to 15.6% in Jacqueville and 13.9% in Grand-Lahou. The overall comparison of HDDS across the departments does not reveal any statistically significant differences.

37.7

**Fig. 4.** Distribution of the Population by Dietary Diversity Score Across Departments

* 1. **Food Groups Consumed by the Study Population**

**Figure (5)** illustrates the distribution of food groups consumed and their dietary diversity scores across the three departments. The most frequently consumed groups, with high diversity scores, include spices, condiments, and beverages; oils and fats; fish and seafood; vegetables; and roots and tubers, with consumption rates ranging from 52.56% to 69.8%. Groups with medium diversity scores include sweets, cereals, meats, as well as legumes, nuts, and seeds. Some groups, such as spices and vegetables, also appear in the medium diversity scores. Conversely, dairy products, eggs, and fruits, although consumed to some extent, exhibit low diversity scores, indicating limited variety in their consumption.

**Fig. 5.** Food Groups Consumed by the Population of the Grands-Ponts by Department and Dietary Diversity Score

* 1. **Reduced Coping Strategies Index (rCSI)**

The analysis of rCSI data, presented in **Table 2**, highlights the level of food insecurity among households across the departments. On average, 27.5% of the population in the three departments is experiencing food insecurity, with proportions of 25.5% in Dabou, 29.1% in Grand-Lahou, and 27.55% in Jacqueville. Additionally, 62.7% of households are under marginal food security pressure, with proportions of 68.6% in Dabou, 58.8% in Grand-Lahou, and 60.8% in Jacqueville. Finally, only 9.8% of households enjoy full food security, with proportions of 5.9% in Dabou and 11.8% in both Grand-Lahou and Jacqueville.

**Table 2 .** Classification of the level of rSCI in the investigation departments

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ITS** | | **SAMSP** | | **AI** | | **Total** | | **P-value** |
| Department | N | % | N | % | N | % | N | % |  |
| Dabou | 21 | 5.9 | 242 | 68.6 | 90 | 25.5 | 353 | 100 | 0.152 |
| Grand-Lahou | 42 | 11.8 | 208 | 58.8 | 103 | 29.4 | 353 | 100 |
| Jacqueville | 42 | 11.8 | 214 | 60.8 | 97 | 27.5 | 353 | 100 |
| **Total** | 105 | 9.8 | 664 | 62.7 | 290 | 27.5 | 1059 | 1000 |
| SA=Food Security; SAMSP=Marginal Food Security Under Pressure; IA=Food Insecurity | | | | | | | | | |

1. **Discussion**

**The objective of this study was to evaluate the eating habits and dietary diversity of households in the departments of Dabou, Grand-Lahou, and Jacqueville.**

The findings reveal that nearly three-quarters of households consume three meals a day, with respective proportions of 59.49%, 74.86%, and 72.44%. This practice, widely observed across various cultures, is associated with health benefits, including optimal weight management and reduced risks of metabolic diseases **[20]; [21]**. However, a significant proportion of households, 36.26% in Dabou, 23.45% in Grand-Lahou, and 24.15% in Jacqueville, limit their consumption to two meals per day. This behavior may be influenced by economic, cultural, or personal factors **[22]**.

Regarding meal frequency, the composition of household meals shows a certain monotony. **Attiéké**, a cassava-based carbohydrate food, is the main staple at each meal. While this food provides an important source of energy, its exclusive consumption limits nutritional diversity, which is essential to ensure a balanced intake of macronutrients and micronutrients. Furthermore, the sauces accompanying these meals, although somewhat varied, primarily consist of a few types, such as clear, vegetable-based, or seed-based sauces. The frequent absence of alternative sauces (leaf-based, peanut, okra, etc.) could not only reduce nutritional diversity but also impact the gustatory appeal of meals, potentially influencing household satisfaction with their diets.

The analysis of protein sources highlights a marked reliance on fish, which is the dominant protein food in the region. This can be attributed to the abundance and accessibility of this resource. However, this concentration on a single protein source can lead to deficiencies in certain essential micronutrients. Diversifying protein sources, particularly by incorporating meat, legumes, eggs, or dairy products, would be beneficial in improving the overall nutrient intake **[23]**.

This low dietary diversity is reflected in the high prevalence of households with low or medium dietary diversity. A less varied diet, coupled with limited intake of essential food groups such as legumes, dairy products, eggs, and fruits, exposes these households to an increased risk of nutritional deficiencies **[24]**. Legumes and seeds, rich in protein and micronutrients, could compensate for the deficit in animal proteins, while dairy products and fruits are essential for calcium, vitamins, and dietary fiber, which are crucial for bone and digestive health **[25]**. These findings align with the work of Marianne and al **[26]**, who also observed low dietary diversity among Sahrawi refugee populations.

Finally, the analysis of the simplified food coping strategies index (rCSI) highlights disparities in food security across the three departments studied. Although the prevalence of marginal food insecurity points to significant vulnerability among households, the lack of statistically significant differences between the departments (p-value = 0.152) suggests that common structural factors influence food trends. These observations are consistent with those of the FAO **[27]** and similar studies in sub-Saharan Africa **[28]**; **[29]**, which emphasize the impact of socio-economic and institutional factors on food security **[30]**. It is therefore imperative to adopt targeted interventions to promote dietary diversity and improve access to nutritious foods in these communities.

**CONCLUSION**

This study highlighted the dietary habits, nutritional diversity, and food security of households in the departments of Dabou, Grand-Lahou, and Jacqueville. Nearly 75% of households consume three meals per day, reflecting a common eating practice, although 25% limit themselves to two meals daily, likely due to economic constraints. Meals are dominated by attiéké and accompanied by poorly diversified sauces, with fish as the primary source of protein. This dietary monotony contributes to low or medium dietary diversity for more than half of the households.

The analysis of food groups reveals limited consumption of dairy products, eggs, and fruits, despite their nutritional importance, and a reliance on oils, tubers, and fish. Moreover, the results show notable food vulnerability, with approximately 27% of households experiencing food insecurity and only 10% in food security. The disparities observed between the departments can be explained by common structural factors, including socio-economic constraints. These findings highlight the need for initiatives to diversify diets and improve household food security, particularly through nutrition education programs and better access to diverse foods.

****Consent****

All authors certify that written informed consent was obtained from the households for the publication of this report and the images associated with it. A copy of this written consent is available for consultation by the editorial office, the editor-in-chief, or the members.

Ethical Approval

All authors hereby declare that all experiments were reviewed and approved by the national committee for ethics in life and health sciences (cnesvs) of côte d'ivoire and were therefore conducted in accordance with the ethical standards outlined in the 1964 declaration of helsinki.

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