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Food Vulnerability of Senegalese Households in the Face of the COVID-19 Crisis: An Assessment by the Food Consumption Score

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ABSTRACT

The COVID-19 pandemic has posed unprecedented challenges to global food security, with particularly severe effects in low- and middle-income countries. In Senegal, where household livelihoods largely depend on informal employment and remittances, the crisis has exacerbated existing vulnerabilities. This study assesses the impact of the pandemic on household food security using the Food Consumption Score (FCS). The analysis combines primary data from a doctoral household survey with secondary data from the National Agency of Statistics and Demography (ANSD). Results indicate significant disruptions in household welfare, with 36% of household heads stopping work during the crisis, and 30% attributing job loss directly to COVID-19. Furthermore, 85% of households reported a decline in income, which substantially limited their ability to access diverse and nutritious food. Remittances emerged as the most fragile income source, with econometric simulations showing that a 25% reduction in transfers leads to a 16.6% decline in the FCS, compared to a 10.3% decline for wages and 2.3% for family business income. The findings highlight a sharp deterioration in household food security during the pandemic, underscoring the vulnerability of households that rely on remittances. The study contributes to the literature by providing micro-level evidence from Senegal and demonstrating the utility of the FCS in capturing crisis-induced shocks. Policy recommendations include strengthening targeted income support, protecting remittance flows, and enhancing social safety nets to mitigate the effects of future shocks on food and nutrition security.

Keywords: Food Security, COVID-19. Food-Consumption-Score, Household-Vulnerability, Senegal.

INTRODUCTION

The COVID-19 pandemic has had profound socioeconomic repercussions across developing countries, with disproportionate effects on households that rely on informal and precarious income sources. In Senegal, where over 90% of employment is concentrated in the informal

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sector, the crisis severely disrupted livelihoods and food access. Even before the pandemic, household food security was fragile, and the combination of job losses, income reductions, and market restrictions has further exposed households to food vulnerability.

Understanding how the pandemic has reshaped food security dynamics in Senegal is critical. Evidence from other West African countries indicates that COVID-19 aggravated pre-existing food deficits and eroded dietary diversity among both rural and urban households [1-2]. These effects were often transmitted through reduced incomes, declines in remittances, and supply chain disruptions that constrained access to diverse and nutritious foods. In response, many households adopted coping strategies such as shifting to less preferred diets, reducing meal frequency, or relying on informal support networks [3-4].

While international and regional studies highlight these broad patterns, empirical evidence specific to Senegal remains limited. Few studies have systematically assessed how pandemic-induced income shocks translated into changes in household food consumption and nutritional outcomes. This gap is particularly relevant given Senegal's heavy reliance on remittances, which represent a vital yet volatile income source. With a focus on the Senegalese context, this research contributes to the literature on the intersection between global health crises and local food systems, while also offering insights into the vulnerabilities of income-dependent households in low- and middle-income settings [5].

This study examines the effects of COVID-19 on household food security in Senegal through the lens of the Food Consumption Score (FCS), a widely used composite indicator of dietary diversity and food frequency. Using both primary survey data collected as part of a doctoral project and secondary data from the National Agency of Statistics and Demography (ANSD), the analysis investigates the extent to which income losses, particularly from remittances and wages, have deteriorated food security. Moreover, the study assesses household coping strategies and examines the broader socioeconomic factors that contribute to vulnerability. By doing so, it aims to provide evidence-based recommendations for strengthening household resilience and informing policies that safeguard food security during future crises.

LITERATURE REVIEW

Conceptual Foundations of Food Security

Food security is commonly defined by the Food and Agriculture Organisation (FAO) as a situation in which "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active and healthy life" [6]. This definition encompasses four interrelated dimensions: availability (the supply of food), access (economic and physical ability to obtain food), utilisation (nutritional quality and dietary diversity), and stability (the sustainability of the first three dimensions over time), as shown in Figure 1. Within this framework, food vulnerability refers to the susceptibility of households to food insecurity due to shocks such as income loss, price volatility, or health crises [2]. Vulnerability is not only a matter of poverty but also of resilience, reflecting the capacity of households to withstand and adapt to shocks without compromising long-term food security.

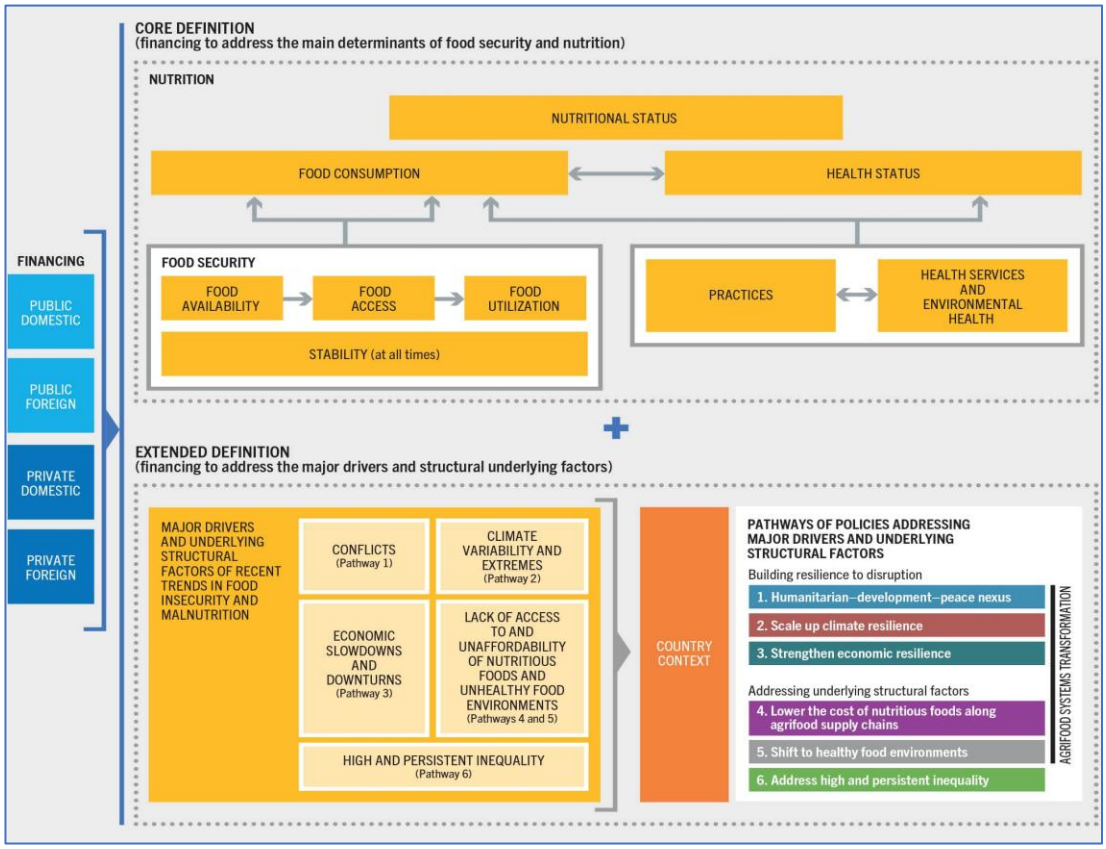

Figure 1: Conceptual Diagram: Financing Food Security and Nutrition (FAO 2024)

Measuring Food Security: The Food Consumption Score

To operationalise household-level food security, various indicators have been developed, including the Household Dietary Diversity Score (HDDS), the Household Food Insecurity Access Scale (HFIAS), the Food Insecurity Experience Scale (FIES) and the Food Consumption Score (FCS). Among these, the FCS and FIES, developed by the World Food Programme (WFP) and Food and Agriculture Organisation (FAO), have become a widely used composite index that combines food frequency, dietary diversity, and the relative nutritional importance of food groups [7]. The FIES classifies households into four categories: food security, mild food insecurity, moderate food insecurity, and severe food insecurity, serving as a proxy for current food access and diet quality [8]. While it has limitations such as not capturing intra-household distribution or seasonal variations, it remains a robust and practical tool for large-scale surveys and emergency assessments [9-10]. Its application in developing countries has provided valuable insights into both chronic and transitory food insecurity.

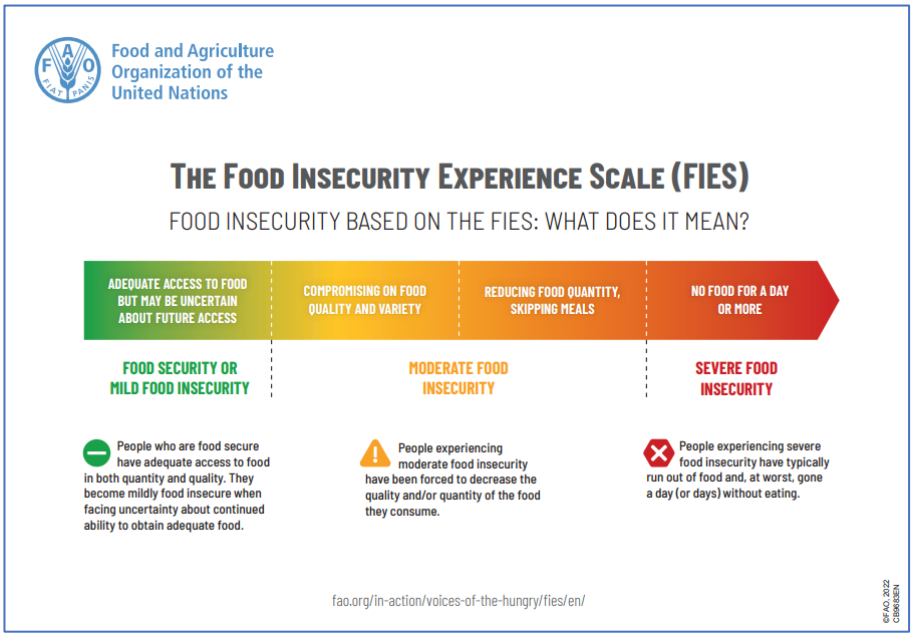

Figure 2: Food insecurity based on the FIES (FAO/WFP: 2022)

COVID-19 and Food Security: Global Evidence

The COVID-19 pandemic introduced unprecedented disruptions to global food systems. Lockdowns, mobility restrictions, and trade disruptions reduced food availability and increased transaction costs (Laborde et al., 2020). Simultaneously, widespread job losses and income shocks reduced household purchasing power, directly undermining food access (Swinnen & McDermott, 2020). These dynamics contributed to significant declines in dietary diversity, particularly in low- and middle-income countries, where households already devoted a substantial share of their income to food [11], as shown in Table 1. Evidence also shows that the pandemic exacerbated reliance on coping strategies such as reducing meal size, shifting to less preferred foods, or drawing on informal social networks [3]. Studies from South Asia and Sub-Saharan Africa reported significant deterioration in household food security, with the urban poor and remittance-dependent households being particularly vulnerable [3,12].

Table 1: Impacts of COVID-19 on Household Food Security Globally

Impacts	Description	Example	Reference
Reduced food availability	Disruptions in production, trade, and supply chains limited the quantity of food accessible to households.	Lockdowns and trade restrictions led to shortages of staple foods in markets.	Laborde et al., 2020
Decline in household purchasing power	Job losses and income shocks reduced households' ability to purchase food, particularly for low-income families.	Informal workers and daily wage earners could no longer afford diverse diets.	Swinnen & McDermott, 2020
Reduced dietary diversity	Households consumed fewer food groups and less nutritious diets due to limited access and affordability.	Families relied more on staples and reduced consumption of fruits,	Béné et al., 2021

		vegetables, and protein sources.	
Increased reliance on coping strategies	Households adopted strategies to manage food shortages, often with negative nutritional consequences.	Reducing meal sizes, consuming less preferred foods, or depending on informal social networks.	Hatab et al., 2024; Balana et al., 2022; Egger et al., 2021

Empirical Evidence in Sub-Saharan Africa and Senegal

In West Africa, the pandemic exacerbated structural vulnerabilities associated with poverty, climate shocks, and dependence on food imports. Research from Burkina Faso, Niger, and Nigeria highlights a worsening of food insecurity during 2020–2021, with both rural farmers and urban informal workers facing reduced dietary diversity and food deficits [1,12]

Senegal provides a particularly relevant case. With over 90% of workers in the informal sector and remittances accounting for a substantial share of household income, the economy proved highly sensitive to the global slowdown. Diop et al showed that GDP growth, projected at 6.8% for 2020, fell to 2.8% due to contractions in tourism, transport, and retail trade [13]. More importantly, household-level surveys revealed that nearly 87% of households reported income declines, with rural areas disproportionately affected. Remittances from Europe, a vital safety net for many families, also decreased significantly, reducing household capacity to secure diverse diets. Despite these insights, few studies have systematically assessed the direct impact of COVID-19 on household food consumption in Senegal using the FCS. Existing analyses tend to focus on macroeconomic projections or descriptive evidence, leaving a gap in micro-level, indicator-based assessments.

Table 2: Impacts of COVID-19 on Food Security in Sub-Saharan Africa and Senegal

Region/Country	Impact of COVID-19	Example	Reference
Burkina Faso, Niger, Nigeria	Worsening food insecurity	Reduced dietary diversity and food deficits among rural farmers and urban informal workers.	Zidouemba et al., 2020; Ceballos et al., 2021
Senegal (national economy)	GDP contraction due to the global slowdown	GDP growth, projected at 6.8%, fell to 2.8% due to declines in tourism, transport, and retail.	Diop, 2020
Senegal (household level)	Income loss and reduced food access	Nearly 87% of households reported income declines, with rural areas being disproportionately affected.	Diop, 2020
Senegal (remittance-dependent households)	Reduced capacity to secure diverse diets	Decline in remittances from Europe limited the household's ability to maintain dietary diversity.	Diop, 2020

Contribution of the Study

This study contributes to the literature by providing a rigorous, household-level assessment of food security in Senegal during the COVID-19 crisis, using the Food Consumption Score as the

principal indicator. By combining primary doctoral survey data with official ANSD statistics, the analysis provides granular insights into how income losses, particularly those from remittances, translate into reduced food consumption and dietary diversity. Moreover, it explores coping strategies and identifies the most vulnerable household categories, thereby advancing both academic debates and policy discussions on food system resilience in crisis contexts.

METHODOLOGY

Food security is measured here by the Food Consumption Score (FCS) indicator. The latter is calculated based on eight product groups that the household consumed in the seven days preceding the survey. The product groups each have an importance (weight) according to their nutrient and energy intake [14]. The table below shows the composition of the eight product groups and their corresponding weights.

Table 3: Product groups and weighting

Food	Group	Weighting
Maize, rice, sorghum, millet, bread and other cereals, cassava, potatoes, sweet potatoes	Cereals and tubers	**2**
Beans, peas, peanuts in shell and nuts and cashews	Pulses	**3**
Vegetables, condiments and leafy greens	Vegetables	**1**
Fruits	Fruits	**1**
Beef, Goat, Poultry, Pork, Eggs and Fish	Meat and fish	**4**
Milk, yoghurt and other dairy products	Milk	**4**
Sugar and sugary products	Sugar	**0,5**
Oils, fats and butter	Oil	**0,5**

Source (N'diaye, 2014)

The weights applied to the groups relate to the quality and quantity of nutrients in household consumption. The first step in calculating the FCS is to identify the food groups presented in Table 3. Then, determine the number of days of the week during which the household consumed at least one product from a food group. Finally, multiply this number of days (NBD) by the weight associated with the group. The FCS is calculated by using Equation 1.

$$\boldsymbol{FCS = \sum_{i=1}^{8} NBD_i * Weight_i} \qquad (\mathbf{1})$$

Where

- NBD is the number of days.

A typology of households is carried out according to the values of the FCS, with a grouping into three classes according to the following criterion:

- *Poor = FCS < 28*
- *Limit = 28 < FCS <= 42*
- *Acceptable = SCA > 42.*

The effects of COVID-19 on the FCS are assessed using the results of a survey conducted by the ANSD to monitor the impact of COVID-19 on households since the beginning of 2020. The exploitation of these results will enable the capture of the variations in household income introduced through a simulation in an econometric model, where the FCS is the dependent variable. Specifically, Equation 2 is given as follows:

$$\boldsymbol{FCS} = \boldsymbol{c} + \sum_{\boldsymbol{i=1}} \boldsymbol{\alpha_i AI_i} + \sum_{\boldsymbol{i=1}} \boldsymbol{\beta_i Hh_i} + \sum_{\boldsymbol{i=1}} \boldsymbol{\gamma_i CH_i} + \boldsymbol{\epsilon} \qquad (\mathbf{2})$$

In equation 2, the variables *Ai* represent the amount of income from the source. The variables *Hh* describe the sociodemographic characteristics of the head of household (age, level of education, marital status, sex, socio-professional category) and the variables *CH* relate to the characteristics of the household (composition, tenure status, etc.).

RESULTS AND DISCUSSIONS

Impact of COVID-19 on Households

Since the emergence of COVID-19 in Senegal in March 2020, household activities have experienced significant disruptions, primarily through channels such as employment, income, private transfers, access to food, health services, and other basic services (Figure 3). Among household heads who were employed before the crisis, 60.0% maintained the same job, 4.0% changed employment, and 36.0% stopped working. Of those who ceased working, 30.0% attributed their job loss directly to COVID-19. These employment disruptions were particularly concentrated in specific sectors: financial and insurance services (48.0%), public administration (41.0%), trade (41.0%), other service sectors (40.0%), transport and telecommunications (36.0%), mining and quarrying (36.0%), construction (25.0%), and manufacturing (25.0%).

These figures highlight the disproportionate vulnerability of service-oriented and informal sectors to pandemic-related shocks, consistent with broader findings across Sub-Saharan Africa [2,15]. The substantial impact on income-generating activities demonstrates the dual nature of COVID-19's effect: not only did it reduce household earning potential, but it also constrained access to essential goods and services, including food and healthcare. The high incidence of job losses in urban formal and informal sectors underscores the structural fragility of Senegal's labour market, where a large proportion of workers are in informal or precarious employment [13]. The disruptions in income and employment also have cascading effects on household food security, as reduced purchasing power limits the ability to acquire diverse and nutritious diets, a trend similarly observed in other low- and middle-income countries during the pandemic [16]. These results provide early evidence that COVID-19 significantly exacerbated economic vulnerability among Senegalese households, particularly those reliant on sectors sensitive to mobility restrictions and market contractions. This has critical implications for targeted policy interventions, such as income support, employment protection, and social safety nets, to mitigate the pandemic's impact on food and nutrition security.

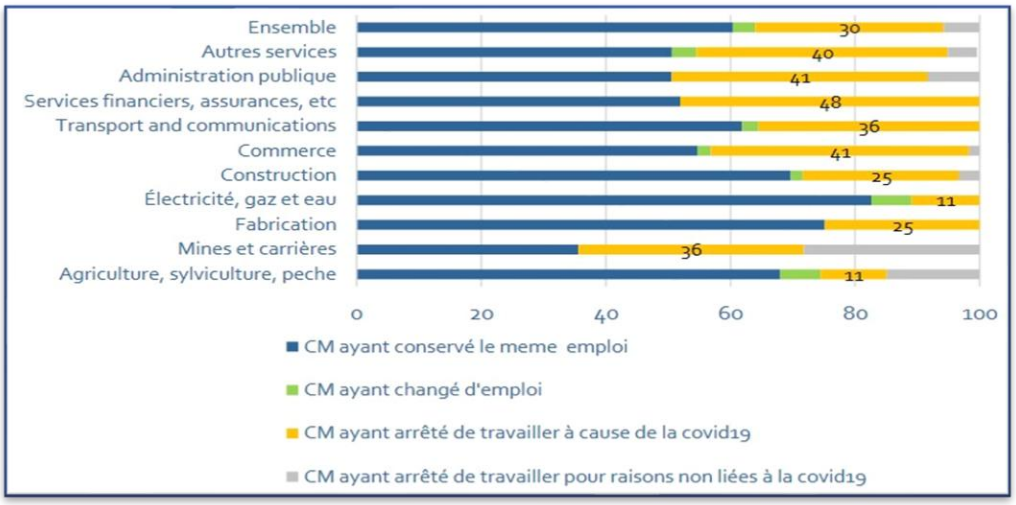

Figure 3: COVID-19 Impact on head of household employment in % (ANSD, 2020)

Impact of COVID-19 on Household Income

Like employment, the level of household income has also been affected by COVID-19. Indeed, the figure below shows changes in household income. As a result, 85.00% of households experienced a decrease in total revenue, 13.00% saw their income remain unchanged, and only 2.00% of households experienced an increase in total income. The data indicate a sharp decline in household income following the COVID-19 pandemic, with 85% of respondents reporting reduced earnings, while only a small minority (2%) experienced an increase in income. This remarkable loss of income underscores the pandemic's severe economic impact on household livelihoods, directly limiting purchasing power and worsening the risks of food insecurity.

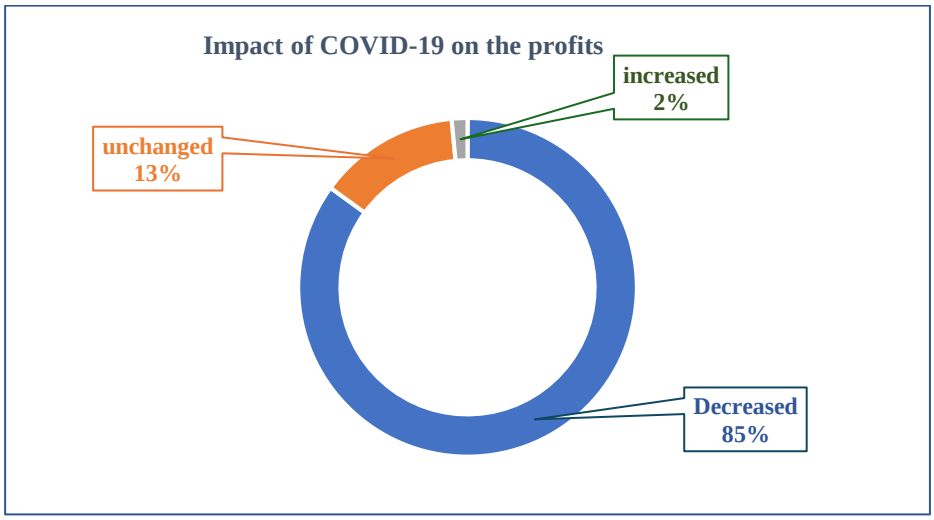

Figure 4: Effects of COVID-19 on household income (data obtained from ANSD, 2020)

Impact of COVID-19 on Access to Food and Sanitary Products

Access to food and health products has also faced barriers. Indeed, Table 4 illustrates the challenges households face in accessing the supplies they need. The results showed that

households mainly needed without being able to stock up on fresh fish (50%), modern bread (31%), hydroalcoholic gels (31%), sugar (29%), masks (27%) and imported rice (22%). These findings highlight the significant gaps in access to both nutritional and sanitary supplies, which may have implications for nutritional security and public health, particularly in contexts of crisis or disruption [17].

Table 4: Effects of COVI-19 on access to products (%)

Product	Percentage of Households Reporting Difficulties	Estimated Number of Households (assuming 100 households surveyed)
Fresh fish	50%	50
Modern bread	31%	31
Hydroalcoholic gels	31%	31
Sugar	29%	29
Masks	27%	27
Imported rice	22%	22

Source: A. BALDE, 2020

Reasons for Non-access to Products

There are several reasons for the lack of access to food and health products by households. To this end, the main reason given is a lack of money (67%), probably due to the drop in household income. In addition, fear of Covid-19 (23%), lack of transport (13%), lack of available medical staff (5%), refusal due to lack of places (2%) and security problems (1%) were also blamed by households for their lack of access to food and health products, as indicated in Figure 5.

The evidence suggests that the COVID-19 crisis severely constrained household access to essential goods and services in Senegal. The most frequently cited barrier was lack of financial resources (67%), which directly reflects the widespread decline in household incomes during the pandemic. As reported in earlier surveys, nearly 87% of households in Senegal experienced income reductions in 2020, with rural areas being disproportionately affected [13,18]. This loss of purchasing power limited the ability of families to acquire both food and health products, exacerbating pre-existing vulnerabilities. Other factors also played a significant role. About 23% of households identified fear of COVID-19 as a barrier, underscoring how perceptions of risk influenced access behaviour, particularly for health services. This finding is consistent with global evidence that health-seeking behaviours declined during the pandemic due to concerns about infection in medical facilities [12,16]. Transport constraints (13%) and medical staff shortages (5%) exposed weaknesses in service delivery, while overcrowding (2%) and security issues (1%) reflected localised challenges. In fact, economic hardship was the main barrier to accessing food and health products, but behavioural, logistical, and institutional factors also played a role.

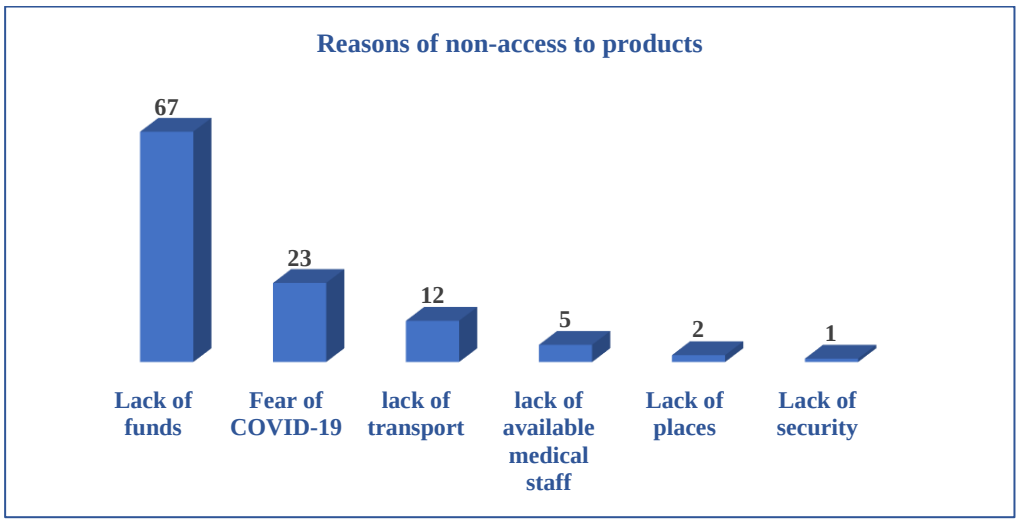

Figure 1: Cause of non-access to products (%)

Structure of Household Food Security

The characteristics of household FCS are shown in the following table. It appears that the overall distribution of the FCS is asymmetric and spread to the left, as evidenced by the negative value of the asymmetry coefficient ($skewness$ = -0,4). This trend is due to the distribution of the SCA of the "$poor$" class, where the skewness coefficient is the only one that is negative ($skewness$ = -1,1). Also, the overall flattening coefficient is positive ($kurtosis$ = 2.2) thus attesting to a distribution that is flatter than the normal distribution (and therefore has more extreme values than the latter). This trend is the same for the other two classes of the FCS (positive kurtosis). In addition, the average (μ) and variance (σ^2) calculate the coefficient of variation (cv) which is the ratio of the standard deviation to the mean ($cv = \frac{\sigma}{\mu}$). Thus, the FCS values for the poor class are more dispersed around their average (= 29.9) than those for the Acceptable class (cv = 23,8%) and the Limit class (cv = 12,6%) : inequalities in diets are higher among poor-class households and slightly less for those in the acceptable class, shown in Table 5. At the same time, dietary profiles are more homogeneous for households classified as borderline [19].

Tableau 5: Characteristics of the distribution of FCS

	FCS Poor	FCS Limit	FCS Acceptable	FCS Global
Mean	20,4	34,1	79,6	73.8
Std. Dev.	6,1	4,3	19,0	24.2
Variance	37,2	18,6	359,5	585.9
Skewness	-1,1	0,01	0,006	-0.4
Kurtosis	3,8	1,7	2,05	2.5

Source: A. BALDE, 2020

The results in Table 3 are supported by those in the following figure, which illustrates the histograms of the overall FCS and the three classes of FCS. The results show that the histogram that is most spread to the left is that of the poor class, while that of the borderline class is the most homogeneous.

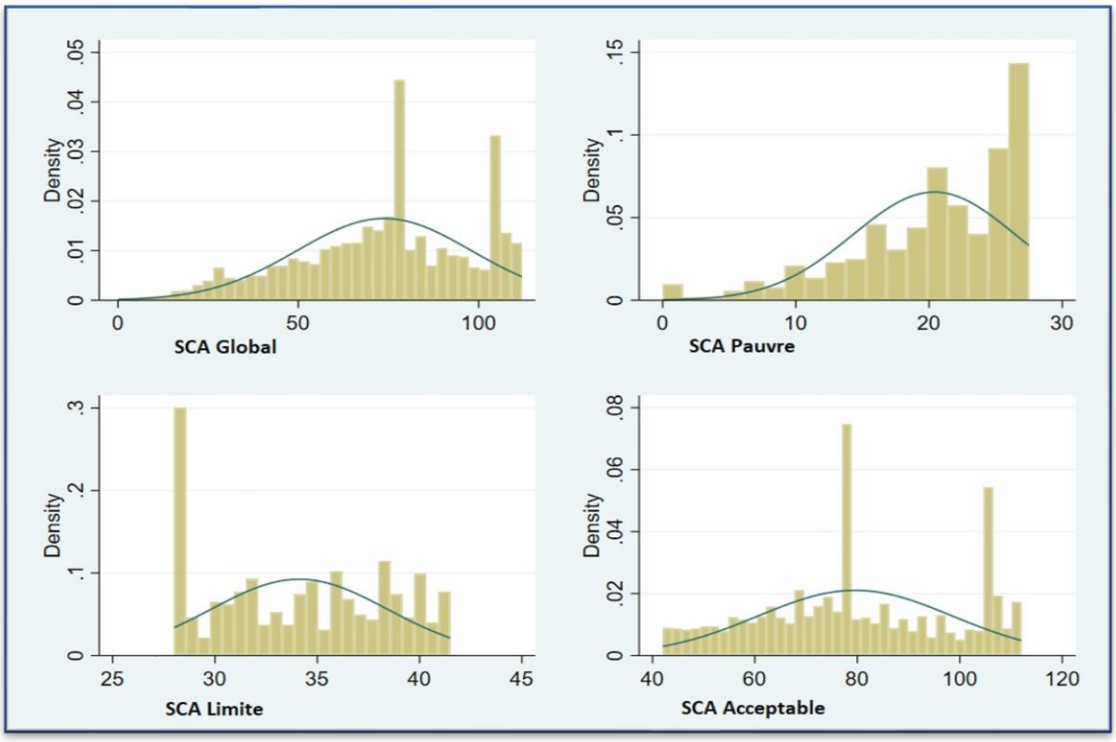

Figure 2: Histogram of the distribution of *the FCS (*Source: A. BALDE, 2020)

Simulation des effets de la Covid-19 sur le FCS

Previous analyses show that most households (85.0%) experienced a decline in total income. Thus, to account for the impact of COVID-19 on the FCS, decreases of 25.0% and 50.0% in salary, transfers, and revenue from the family business will be simulated. The choice of these rates is based on the fact that the most significant proportion of informal production units (30.0%) recorded a decline in production of between 25.0% and 50.0% [18].

Tableau 6: Impact of Covid-19: 25% drop in revenues from the three sources

	Contrast	Std. Err.	[95% Conf.	Interval]
Wages	-0,103	0,013	-0,129	-0,076
Transfers	-0,166	0,016	-0,198	-0,134
Family business	-0,023	0,005	-0,033	-0,013

Source: A. BALDE, 2020

The simulation model is the one presented in equation 2. Table 6 presents the results of simulations conducted separately for each of the three variables: income from wages, transfers, and family business. The results show that a 25.0% drop in revenue from wages leads to a 10.3% decline in the FCS, assuming all other factors remain equal. This same decrease, applied solely to income from transfers received by households, results in a 16.6% decrease in household FCS. As for the revenue from the family business (excluding trade), the impact of a 25.0% drop in its value is less significant (-2.3%). Thus, transfers received by households are the channel that most weakens household food security [19]. This situation remains worrying, as studies have shown that the crisis could lead to a 20.0% drop in global migrant remittances,

a 23.0% decline in sub-Saharan Africa, and a 30.0% decrease in Senegal [20]. The pessimistic situation of a 50.0% decline has a more pronounced impact on the FCS. Indeed, the results in Table 7 show that a halving of income from transfers reduces household FCS by 33.2% indicating a poor diet, which has a substantial impact on food security. Additionally, a decrease in revenue from salary reduces the FCS by 20.5% and that of the family business by 4.6% [21].

Table 7: Impact of Covid-19: 50% drop in revenues from the three sources

	Contrast	Std. Err.	[95% Conf.	Interval]
Wages	-0,205	0,026	-0,258	-0,153
Transfers	-0,332	0,032	-0,395	-0,268
Family business	-0,046	0,0107	-0,069	-0,025

Source: A. BALDE, 2020

As the COVID-19 crisis is affecting the entire economy, it is more realistic to conduct combined simulations on sources of income, applying reductions simultaneously. Thus, Table 8 illustrates the results of a simultaneous decline in revenue from wages, transfers and family businesses. Notably, a 25.0% drop in income from these three sources results in a 29.2% decrease in the FCS, while a 50.0% drop leads to a 58.3% decline in the FCS. The simulation of simultaneous income shocks across wages, transfers, and family businesses reveals the magnitude of household vulnerability in Senegal during the COVID-19 crisis. A combined reduction of 25% across these income sources translates into a 29.2% decline in the Food Consumption Score (FCS), while a 50% reduction produces an even more alarming 58.3% decline [22]. These results underscore the compounding effect of multiple shocks when households lack diversified and resilient income streams. The findings resonate with broader evidence on systemic stressors within fragile economies. (Keita et al, 2025 and Laborde et al,) emphasise that structural vulnerabilities in socio-economic and environmental systems are often exacerbated when multiple shocks coincide [23-24]. Their study illustrates how compounding pressures can undermine the resilience of essential systems, such as agriculture and soil health, with cascading consequences for food security.

Table 8: Impact of Covid-19: simultaneous decline in revenues from all three sources

	Contrast	Std. Err	[95% Conf. Interval]	
Decrease 25%	-0,292	0,022	-0,335	-0,248
Drop 50%	-0,583	0,045	-0,671	-0,495

Source: A. BALDE, 2020

CONCLUSION

The COVID-19 crisis has had a profound impact on household welfare and food security in Senegal. The analysis reveals that income shocks, particularly the decline in remittances, are the most significant channel through which the pandemic has impacted household diets. Econometric simulations suggest that a 25% reduction in remittances leads to a 16.6% decline in the Food Consumption Score (FCS), while a 50% reduction results in a more substantial 33.2% decline. This deterioration in dietary diversity and nutritional quality highlights the vulnerability of remittance-dependent households, especially in a context where informal employment already dominates the economy. Beyond remittances, the findings also reveal how

job losses and reduced earnings in multiple sectors have constrained household purchasing power, thereby compounding food insecurity. The pandemic has exposed the fragility of food systems and the limited resilience of households to withstand shocks of this scale. To mitigate these effects, policies should not only safeguard remittance flows by supporting migrant workers abroad but also strengthen domestic social safety nets, diversify income sources, and improve access to affordable and nutritious foods. Investments in rural development, agricultural resilience, and market infrastructure are equally crucial to reducing structural vulnerabilities. Ultimately, the study highlights the value of the FCS as a practical tool for monitoring food security during crises, while providing micro-level evidence that can inform targeted and inclusive policy interventions.

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Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. Corresponding author's email: kd70405936@gmail.com.

Declarations

- **Ethics approval and consent to participate:** Not applicable.
- **Consent for publication:** Not applicable.
- **Competing interests:** The authors declare no competing interests.

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