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# Impact of a food voucher program in alleviating household food insecurity in two cities in Senegal during a food price crisis

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## Abstract

Cash-based transfer programs is a promising approach to alleviate household food insecurity in low-income countries, however evidence from rigorous impact evaluation in West Africa is still scarce. This study measured the impact of a food voucher distribution of the World Food Program targeting vulnerable households in two cities of Senegal. We used a quasi-experimental design and a propensity score matching to compare beneficiary and non-beneficiary households ( $n = 1008$  in Dakar-Pikine and  $n = 996$  in Ziguinchor) before and after the intervention. Measured outcomes included the standard Household Dietary Diversity Score (HDDS), the Household Food Insecurity Access Scale (HFIAS) and the Coping Strategy Index (CSI). A difference-in-difference approach was used to measure the program impact. In Dakar-Pikine, the mean HDDS decreased between the baseline and endline, similarly in all households ( $p$  value = 0.2). In Ziguinchor, the HDDS decreased between the two rounds, but significantly more in the non-beneficiary compared to the beneficiary households ( $-0.6$  vs.  $-0.3$  points,  $p$  value = 0.02). According to the HFIAS, severe food insecurity decreased from 83.9% to 64.6% amongst beneficiaries in Ziguinchor, while it remained high amongst non-beneficiaries ( $p$  value = 0.0003). A similar protective effect was observed using the CSI. In Dakar-Pikine, the proportion of severely food insecure households did not vary between the 2 rounds in both groups ( $p$  value = 0.17). Household's food security deteriorated between baseline and endline, because the intervention was implemented at the time of a global economic crisis. The food voucher program alleviated the effect of this crisis in Ziguinchor, but not in Dakar-Pikine.

**Keywords** Quasi-experimental evaluation · Food vouchers · Dietary diversity · Impact evaluation · Urban food security · Senegal · Sub-Saharan Africa

## 1 Introduction

Significant progress has been made in reducing global food insecurity rates over the past 20 years. According to the Food and Agriculture Organisation (FAO), the estimated worldwide prevalence of undernourishment has declined from 18.6% in 1990–92 to 10.6% in 2015, but this prevalence is stagnating since then (FAO et al. 2019). An intolerable number of people

still suffer from food and nutrition insecurity, in particular in Southern Asia and sub-Saharan Africa where progress is slow. As household food insecurity has been associated with either stunting in children under 5 or with obesity in school-age children, adolescents and adults, depending on contexts, it is essential to continue the efforts (FAO et al. 2019).

Social protection programs are thought to have contributed to the global effort. Such programs have become a mainstay in social transfers and poverty reduction strategies throughout Latin America, and are increasingly being implemented in Sub-Saharan Africa (Garcia and Moore 2012). Among them, cash transfer (CT) programs - which imply giving money in the form of cash, checks, money orders or vouchers, and which can either be conditional or unconditional - are becoming increasingly popular worldwide, probably due to their versatility. Numerous large-scale conditional cash transfer (CCT) programs have indeed been implemented and evaluated for more than 15 years in Latin America. Most of these

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programs included high-quality monitoring systems, as well as rigorous evaluation schemes, often as part of a research component supported by academic institutions, a strong support from governments, and appropriate funding. The positive and consistent impact of these CCT programs on poverty reduction has been well documented, which in part may explain their popularity and adoption by a number of countries in the region and beyond (Arnold et al. 2011; Fiszbein et al. 2009; Handa and Davis 2006). The evidence on the impact of CCTs on food security and food consumption is also strong. A number of CT programs have been shown to increase household food expenditure and food consumption. In Colombia for example, household food consumption increased both in terms of quantity (energy intakes) and quality (intakes of nutrient-rich foods such as fruits, vegetables, meat and dairy products) (Attanasio and Mesnard 2006). Positive impacts on food consumption were also observed in Honduras and Mexico City (Attanasio et al. 2010; Hoddinott and Skoufias 2004; Wiesmann and Hoddinott 2007). In the latter, as well as in Nicaragua, specific impacts on the consumption of fruits and vegetables and on dietary diversity have been shown (Leroy et al. 2010; Maluccio and Flores 2005).

Social transfer strategies that are successful in Latin America may not be easily transferable to sub-Saharan Africa, where constraints and development issues are different. In Africa, social protection programs, including food distribution, have historically been and remain mainly based on external assistance. The lack of capacity and resources to reach large numbers of poor and food insecure people, the restricted fiscal space, or the lack of political will are often given as explanations for reluctance of governments to adopt and scale-up such programs (Adato et al. 2004; Ellis 2010). Two main types of social protection programs nevertheless exist on the continent. On the one hand, there are some true national social protection policies, usually in the form of pension schemes allocated by governments to specific groups (orphans, elderly, etc.) (Devereux 2007), – who are not necessarily the most in need (Adato et al. 2006; Devereux and Pelham 2005). These programs are mainly encountered in Southern Africa (South Africa, Namibia, Lesotho, Botswana and Swaziland) and have rapidly expanded to Eastern Africa (Kenya, Mozambique, Malawi, Uganda, Rwanda), with one exception in West Africa (Ghana). On the other hand, pilot projects, rather than national policies, are increasingly implemented throughout the continent. These projects are diverse in design and implementation, but share common features, at least in West Africa: they target the most vulnerable population groups, and are relatively small in scale, limited in time and supported by external donors. So far none of these pilot projects has become a government-owned social protection program with a national coverage, despite some attempts in Malawi and Ghana. A few large social transfer programs however exist in Eastern and southern Africa, and even one in

Senegal, West Africa. These programs mostly aim at reducing poverty and/or improving food security or school attendance (Kakwani et al. 2005). In 2008 the Transfer Project was initiated by UNICEF Innocenti, the FAO, the University of North Carolina and several national governments, with the objectives of sharing lessons learned, experiences and expertise from CT program evaluation in Africa. The unconditional CT programs included in this project benefited from rigorous evaluations, which concluded towards an improvement in household's food security either by the use of income for food or by the purchase of productive assets (livestock, agricultural equipment, fertilizers) (Davis et al. 2016).

Despite these promising findings, the diversity of CT designs and modalities make it difficult to take stock from existing impact data. In particular, most of the evaluated programs were CT programs, while programs that distributed food or food vouchers are fewer and insufficiently evaluated. The International Food Policy Research Institute (IFPRI), on the basis of a 4-country study funded by the World Food Program (WFP), recently analysed the relative and absolute effectiveness of food versus cash versus voucher distributions in improving household food security and other measures of well-being. The findings indicated that the relative effectiveness of different modalities heavily depends on contextual factors such as the severity of food insecurity and the functioning of markets for grains and other foods (Hoddinott et al. 2013). In Democratic Republic of Congo, a randomized trial comparing cash versus vouchers found that both types of intervention had similar effects on total food expenditure (Aker 2013).

The 2007–2008 food price crisis deeply affected Senegal, like many other countries in Sub-Sahara Africa. Poor households living in cities were particularly affected since their food supply depended entirely on markets. Between November 2007 and November 2008, a 39% increase in prices of unprocessed cereals was observed in the country, while the price of imported rice almost doubled (Agence Nationale de Statistique et de Démographie 2009). As the food vulnerability situation of urban households remained poorly known, the World Food Program (WFP) and collaborates carried out a food security survey in the three largest cities of the country (Pikine, Kaolack and Ziguinchor). The results revealed high rates of household's food insecurity and the use of negative coping strategies such as decreasing the number of meals consumed per day and/or quantities consumed, reducing the quality of meals, and even begging. Food expenditure also accounted for a large share of the household's budget in all three cities (56 to 59%). In such a context, and because markets were functional, the WFP and the government of Senegal identified a cash-based intervention as the most appropriate to alleviate the effect of the food crisis on household's food security. In 2010–2011 WFP implemented a food voucher distribution for 6 months in poor households living in Dakar-Pikine



(a vulnerable district of Dakar, the capital city) and in the smaller city of Ziguinchor, South Senegal. This paper presents the results of the impact evaluation of this program on household's food security and dietary diversity, using a quasi-experimental design.

## 2 The food voucher distribution program

The overall objective of the program was to compensate the decline in household's purchasing power caused by high food prices and reduced employment opportunities, in urban contexts where food products were however available. Dakar-Pikine was selected as the pilot area, where the program started in July 2010 and targeted 8806 vulnerable households. Lessons drawn from this first experience were used to implement a similar program in Ziguinchor in April 2011, which targeted 7137 vulnerable households. Quotas of households to be served was determined by financial constraints. Households were selected based on a participatory process in both cities: a local committee was in charge of providing a list of the most vulnerable districts, and of the most vulnerable households within each district, using pre-defined criteria presented in Table 1. In Ziguinchor, all districts were considered vulnerable and were, therefore, targeted by the program. In both cities the lists of households provided by local committees were checked by WFP staff using proxy-means test (PMT) questionnaires administered during home visits.

**Table 1** List of criteria used for the targeting of the intervention in Dakar-Pikine

Criteria for selection of the most vulnerable districts
Flooding
Access to safe drinking water
Sanitation/waste management
Population density
Health services
Schooling services
Housing scheme
Access to electricity
Criteria for selection of the most vulnerable households within districts
Food consumption (based on the number of meals/day)
Presence of children with malnutrition
Presence of at least two children under 5
Household member with handicap or chronic disease
Presence of a pregnant women
More than 2 persons older than 65 years
Household surviving from begging
Household whose house was flooded
Household living in a hut

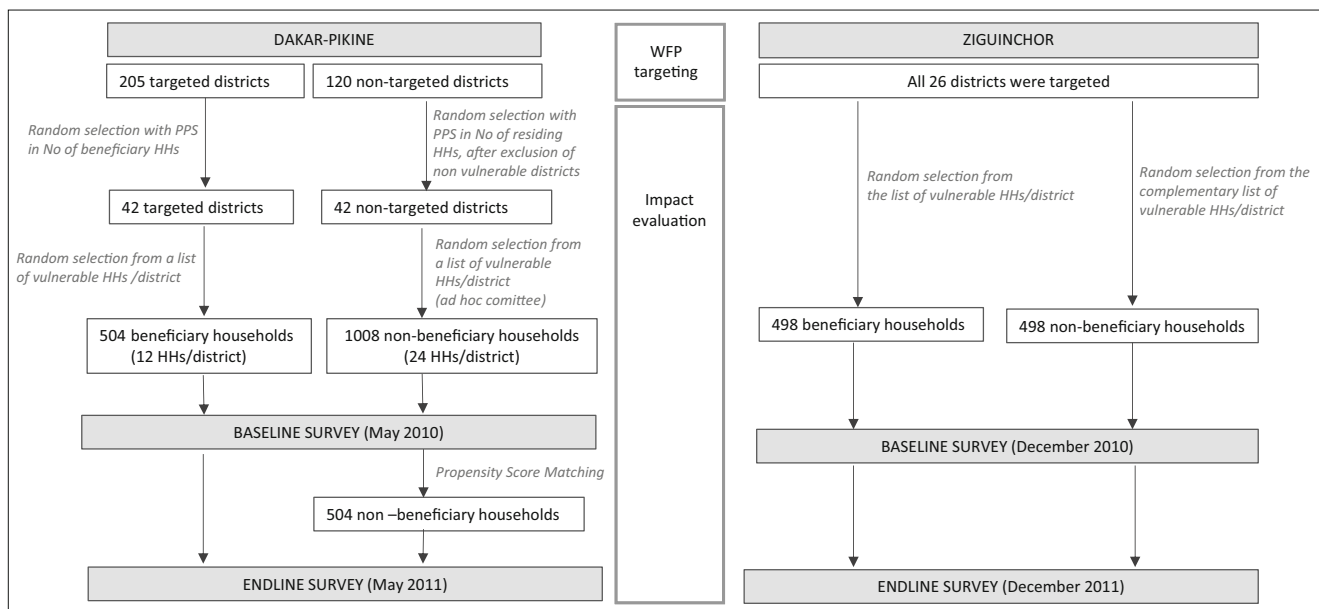
Depending on their PMT result, households were either maintained into or excluded from the program.

The program consisted in distributing paper vouchers worth 3000 FCFA (~US\$5) to beneficiary households on a monthly basis during 6 months. One voucher per person was granted, with a maximum of 6 vouchers per household (i.e. a maximum of 18,000 FCFA per month and per household). Households redeemed the vouchers for pre-defined food products (rice, maize, sorghum, cooking oil and sugar) in shops that had signed a contract with WFP. In Dakar-Pikine only 6 distributions were organized within a 10-month period (July 2010–May 2011), due to logistical difficulties; in Ziguinchor 7 distributions were organized within a 7-month period (April–October 2011).

## 3 Material and methods for impact evaluation

### 3.1 Study design

The evaluation was based on a quasi-experimental design. This consisted in a non-randomized controlled longitudinal study where households who benefited the program were compared to households who did not, before (“baseline”) and after (“endline”) the program. Sampling procedures were slightly different between cities (Fig. 1). In Dakar-Pikine, a two-stage cluster sampling was used to randomly select targeted districts and beneficiary households from the lists of beneficiary districts and households provided by the program: 42 targeted districts were randomly selected proportionally to the number of inhabitants per district; 12 beneficiary households per district were then randomly selected from the lists. A total of 504 households were selected to participate in the study. A slightly different process was used to select non beneficiary households: 42 non-targeted districts were also randomly selected proportionally to the number of inhabitants per district; there was however no available list of vulnerable households living in these districts. A local committee was constituted to produce this list, using WFP's criteria to target beneficiary households (Table 1). Post-identification checking was however not performed by WFP. A total of 1008 vulnerable non-beneficiary households were identified using this process. A propensity score was calculated for each of these households using a logistic model predicting the probability of being a beneficiary, using a large set of demographic and socioeconomic variables (Fortin et al. 2011). The 504 households who had the highest propensity scores were selected in the study in order to ensure the best comparability with the beneficiary households at baseline. The final sample size in Dakar-Pikine allowed detecting a 0.4 point difference in household dietary diversity score (HDDS) between groups, with a 5% level of significance and a 90% study power, and considering a 25% lost to follow-up between baseline and



**Fig. 1** Sampling procedure for beneficiary and non-beneficiary households in Dakar-Pikine and Ziguinchor

endline and a cluster effect of 1.5. In Ziguinchor, a simple random sampling, stratified by district, was used to sample a total of 498 households from the list of beneficiaries. This sample size allowed detecting a 0.3 difference in HDDS between groups. The same number of non-beneficiary households was selected in each district, from a supplementary list of vulnerable households provided by the local committee.

### 3.2 Data collection

The baseline survey in Dakar-Pikine was conducted in May 2010, before the first vouchers were distributed, and the endline survey was conducted just after the last voucher distribution, in May 2011. In Ziguinchor the baseline and endline surveys were conducted in December 2010 and 2011, respectively. Unexpected delays in intervention implementation caused a 3-month gap between the baseline and the first distribution in Ziguinchor. Data were collected by trained enumerators through face-to-face interviews during home visits, using pre-tested questionnaires and Personal Digital Assistant. The respondent was preferably the household head or the first spouse otherwise. The questionnaire included detailed information on household's sociodemographic characteristics, education, housing quality, assets, food consumption, food insecurity, coping strategies, food and non-food expenditures, debts and savings, as well as on the mothers' and children's characteristics and children food consumption. The endline questionnaire also included a section on household's experience and satisfaction with the voucher distribution.

### 3.3 Outcome indicators

#### 3.3.1 Household dietary diversity score (HDDS)

The HDDS is an established proxy measure of household food access (Swindale and Bilinsky 2006), which is the ability of a household to acquire food in sufficient quality and quantity to meet all household members' nutritional requirements for productive lives. The score is calculated by summing up the number of food groups consumed at home by any of the household members in the previous 24 h from 12 food groups (cereals, roots and tubers, vegetables, fruits, meat and poultry, eggs, fish and seafood, pulses/legumes/nuts, milk and milk products, oils and fats, sugar and honey, and condiments). The HDDS theoretically varies from 0 to 12.

#### 3.3.2 Household food insecurity access scale (HFIAS)

The HFIAS is an established measure of food security that has been developed by Food And Nutrition Technical Assistance (FANTA) project (Coates et al. 2007). It consists of 9 specific statements about the accessibility of foods for the household's members as well as household's concern about food. The respondent, preferentially the head of household or the woman in charge of food provisioning/cooking, is asked whether each statement happened at all in the past 30 days (yes or no) and, if yes, how often it occurs over the period. A score is allocated for each question as follows: zero if the statement never occurred, 1 point if it occurred 1 or 2 times (rarely), 2 points if it occurred 3–10 times (sometimes), and 3 points if it occurred

>10 times (often). These points are summed up to compute the HFIAS, ranging from 0 (food security) to 27 (maximum food insecurity). In this study the HFIAS was divided into 2 categories to determine severe food insecurity versus other categories, as defined in the FANTA guide (Coates et al. 2007).

### 3.3.3 Coping strategies index (CSI)

Households were asked what kind of strategy (over a list of 5 pre-determined strategies) they used in case they did not have enough food or enough money to buy food in the past 7 days (Maxwell and Caldwell 2008). The frequency of use of these strategies was taken into account, as well as standard weights allocated to each strategy depending on its severity. The index may vary from 0 (no strategy is used) to 28 (maximum food insecurity).

### 3.3.4 Household food expenditure

Food expenditure were recorded using a recall of expenses on the previous day, week, or month for items bought daily, weekly, or monthly, respectively. All expenses were then converted into daily food expenditure, summed up, and divided by the total number of adult-equivalents (AE) in the household, calculated based on individual energy requirements (FAO et al. 2001). Food expenditures were log transformed and geometric means are presented in this paper.

### 3.3.5 Demographics

Basic demographic data such as age, gender, and size of household were collected. A youth ratio (number of household members <15 y of age/number of persons  $\geq$  15 y) and an economic dependency ratio (number of people not contributing to household expenditure/number of people contributing) were also computed.

## 3.4 Data management and statistical analysis

Data cleaning, management and analysis were performed using SAS 9.3 (SAS Institute Inc., Cary, NC, USA). Comparability of households' characteristics at baseline between intervention and control groups was checked first. Results are presented by group, in means  $\pm$  SD for quantitative variables and in frequency  $\pm$  SE for qualitative variables. Statistical models used for the comparisons (beneficiary vs. non-beneficiary) were linear regression for quantitative continuous variables and logistic regression for qualitative binary variables. To assess the impact of the interventions a difference-in-differences approach was used (Lance et al. 2014). Mixed models were computed with each of the outcome indicators as dependent variable. Fixed effects were the status of group (beneficiary/non beneficiary), the survey

(baseline/endline), their interaction (status of Group X Survey), as well as potential confounding factors. Random effects were the cluster design effect (only in Dakar-Pikine) and the repetition of measurements in the same households. In all models, the interaction term Group X Survey enabled detecting a change over time between the beneficiary and non-beneficiary groups. Potential confounding factors were variables for which level changed differently in the two groups between baseline and endline. These factor were identified in separate regression models including an interaction term "status of Group X Survey"; variables were retained as confounding factors if this interaction term was statistically significant at  $p < 0.15$  to account for the lower power of interaction tests compared with main effects (Brookes et al. 2004). The analysis was performed on an "intent-to-treat" basis with a level of significance fixed at 5%. In Dakar-Pikine, observations were weighted according to the sampling scheme.

## 3.5 Ethics

The protocol of the study was submitted for ethical clearance from the National Ethical Committee of Research, Ministry of Health, Dakar, Senegal on 2010, April 19th (Authorization No SEN12/10). Informed consent was obtained from all individual participants included in the study.

## 4 Results

### 4.1 Comparison of beneficiary and non-beneficiary households at baseline

Beneficiary and non-beneficiary households had similar sociodemographic characteristics at baseline, in both cities (Table 2). In Ziguinchor, the only differences detected between groups were the proportion of household heads owning their house (58.5% for non-beneficiaries versus 48.4% for beneficiaries,  $p = 0.02$ ) and their dependency ratio ( $p = 0.007$ ).

### 4.2 Changes in basic characteristics of households between baseline and endline

Most sociodemographic characteristics of households did not vary between baseline and endline, or varied in the same way between beneficiary and non-beneficiary groups. In Dakar-Pikine however, the average household size increased from 11.7 persons at baseline to 12.9 people at endline among beneficiaries, whilst it increased from 10.9 to 12.5 people among non-beneficiaries ( $p$  value for interaction = 0.02). Household size was therefore considered as a potential confounding factor and added as covariate in all analyses regarding Dakar-Pikine samples.



**Table 2** Comparison household's characteristics at baseline

	Dakar-Pikine				<i>P</i> <i>value</i> <sup>a</sup>	Ziguinchor				<i>P</i> <i>value</i> <sup>a</sup>
	Beneficiary		Non beneficiary			Beneficiary		Non beneficiary		
	N	Mean (SE) or Frequency [95% CI]	N	Mean (SE) or Frequency [95% CI]		N	Mean (SE) or Frequency [95% CI]	N	Mean (SE) or Frequency [95% CI]	
Age of HH <sup>b</sup> (year)	377	54.5 (0.9)	424	55.4 (0.7)	0.44	409	53.7 (0.6)	404	54.0 (0.7)	0.70
Household size (No of persons)	400	11.7 (0.4)	454	10.9 (0.3)	0.10	422	9.9 (0.2)	416	10.3 (0.3)	0.21
Youth ratio	399	0.74 (0.04)	453	0.70 (0.04)	0.51	422	0.67 (0.03)	415	0.65 (0.04)	0.81
Dependency ratio	354	3.5 (0.2)	391	3.21 (0.14)	0.28	400	3.8 (0.2)	413	4.4 (0.2)	0.007
Gender of HH	398		452		0.34	417		410		0.05
Male		57.2 [49.9–64.6]		52.6 [4.6–58.7]			54.5 [49.6–59.3]		47.4 [42.5–52.3]	
Female		42.8 [35.4–50.1]		47.4 [41.3–53.4]			45.5 [40.7–50.7]		52.6 [47.7–57.5]	
Matrimonial status of HH	401		458		0.23	430		428		0.19
Single		5.8 [1.1–10.6]		3.9 [1.7–6.1]			7.1 [4.7–9.5]		6.5 [4.1–8.8]	
1 spouse		46.3 [39.8–52.8]		43.7 [38.6–48.7]			48.8 [43.7–53.3]		46.1 [41.1–50.6]	
> 1 spouse		25.0 [20.5–29.5]		25.1 [20.7–29.5]			15.8 [12.2–19.3]		15.9 [12.4–19.3]	
Divorced		2.1 [0.6–3.7]		3.1 [1.6–4.5]			3.9 [2.0–5.7]		3.2 [1.5–4.9]	
Widow		20.7 [13.9–27.4]		24.2 [19.1–29.4]			24.5 [20.3–28.6]		28.4 [24.0–32.7]	
Education of HH	400		458		0.48	430		428		0.96
None		58.7 [51.3–66.1]		55.5 [48.9–62.0]			57.9 [53.2–62.6]		57.0 [52.3–61.8]	
Coranic school		20.4 [15.6–25.3]		21.2 [17.1–25.3]			7.9 [5.3–10.4]		9.4 [6.6–12.1]	
Primary school		13.8 [8.9–18.7]		14.8 [11.0–18.6]			23.3 [19.3–27.3]		23.6 [19.5–27.6]	
Secondary school		6.5 [2.6–10.4]		7.9 [5.3–10.4]			10.5 [7.6–13.5]		9.1 [6.3–12.0]	
Higher school		0.5 [0.0–1.5]		0.7 [0.0–1.4]			0.4 [0.00–1.0]		0.9 [0.01–1.8]	
Profession of HH	400		458		0.93	430		428		0.33
Employed		45.3 [37.3–53.3]		43.9 [38.8–49.0]			70.0 [65.6–74.4]		65.6 [61.0–70.1]	
Job seeker		5.4 [3.0–7.8]		7.0 [4.1–9.9]			6.0 [3.7–8.3]		5.8 [3.6–8.0]	
Housewife		32.2 [24.7–39.7]		34.1 [28.6–39.5]			17.3 [13.6–20.9]		22.5 [18.5–26.5]	
Retired		11.2 [6.9–15.5]		10.5 [7.5–13.4]			4.5 [2.6–6.5]		2.9 [1.3–4.5]	
Other		5.9 [1.6–10.2]		4.6 [2.4–6.7]			2.2 [0.4–2.6]		3.2 [1.5–4.9]	
Housing status	400		458		0.53	430		428		0.02
Owner		65.1 [58.8–71.3]		60.9 [54.0–67.2]			48.4 [43.7–53.2]		58.5 [53.8–63.2]	
Co-owner		7.6 [3.9–11.3]		12.2 [7.6–16.9]			8.5 [5.8–11.2]		5.8 [3.6–8.0]	
Tenant		15.7 [11.6–19.9]		15.5 [10.9–20.1]			16.0 [12.4–19.5]		15.2 [11.8–18.7]	
Co-tenant		4.9 [1.9–7.8]		5.0 [2.2–7.8]			1.9 [0.6–3.3]		3.3 [1.6–5.0]	
Housed for free		6.7 [3.8–9.6]		6.3 [4.5–8.2]			25.1 [21.0–29.3]		17.2 [13.5–20.8]	

<sup>a</sup> Model used: linear regression for quantitative continuous variables (*Proc surveyreg*) and logistic regression for qualitative binary variables (*Proc surveylogistic*), with the districts considered as clusters

<sup>b</sup> HH = head of household

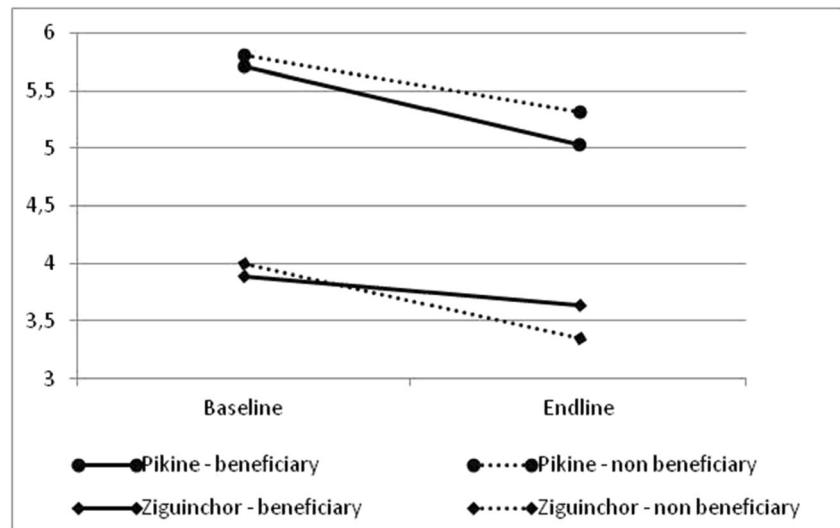
### 4.3 Impact measurement

#### 4.3.1 Household dietary diversity

The mean HDDS decreased between baseline and endline in Dakar-Pikine, whether the households received the vouchers or not (−0.7 and −0.5 points respectively, *p* value for interaction = 0.2) (Fig. 2). This was due to a decrease in the

frequency of consumption of fish and roots/tubers, while a significant increase in frequency of consumption of condiments was also observed in this city (Fig. 3a). In Ziguinchor, a decrease in HDDS between the two rounds was observed in all households; however the decrease was stronger in non-beneficiary households than in beneficiary households (−0.6 points versus −0.3 points, *p* value for interaction = 0.02). A decrease in the frequency of consumption of fats, vegetables

**Fig. 2** Change in the mean household dietary diversity score in beneficiary and non-beneficiary households



and legumes was indeed observed in non-beneficiary households, but not in beneficiary households (Fig. 3b).

#### 4.3.2 Household food insecurity

In Ziguinchor, the proportion of severely food insecure households significantly decreased in the group that received vouchers between baseline and endline (from 83.9% to 64.6%), while it remained almost the same in the non-beneficiary group ( $p$  value for interaction = 0.0003) (Table 3). The risk of being severely food insecure after the intervention was 1.6 times higher in non-beneficiary households compared to beneficiary households, while the corresponding figure at baseline was 0.7. In Dakar-Pikine, the proportion of severely food insecure households remained stable in both groups ( $p$  value for interaction = 0.17).

#### 4.3.3 Coping strategies

In Ziguinchor, the mean CSI did not vary between the two rounds of survey in beneficiary households (approximately 18 at baseline and endline), while it increased from 16.9 to 22.5 in non-beneficiary households ( $p$  value for interaction <0.0001), indicating a higher food insecurity at endline in these households (Table 3). The mean CSI in Dakar-Pikine decreased between baseline and endline survey, whether households received the vouchers or not ( $p$  value for interaction = 0.41).

#### 4.3.4 Household food expenditure

Monthly food expenditures per adult-equivalent decreased between baseline and endline in all households in both cities ( $p$ -values for interaction = 0.39 in Dakar-Pikine, 0.43 in Ziguinchor) (Fig. 4).

#### 4.4 Use of vouchers

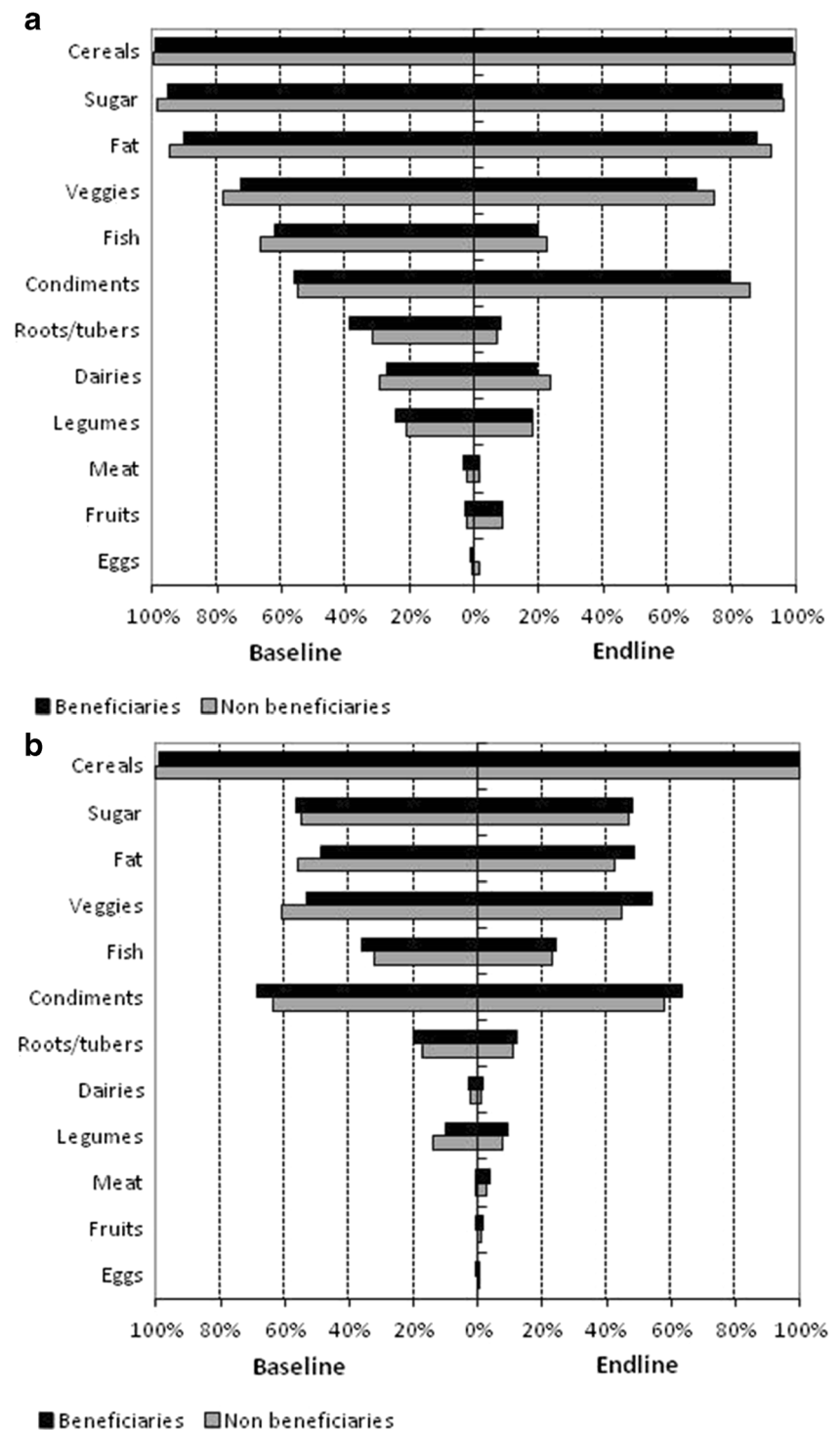
At endline a questionnaire was administered to beneficiary households in both cities in order to investigate how the vouchers were used. Results refer to a subsample of 427 households in Ziguinchor and 352 households in Dakar-Pikine. In both cities in exchange for the vouchers, beneficiary households mainly chose rice (97.2 and 91.5% in Ziguinchor and Dakar-Pikine, respectively), cooking oil (87.7 and 78.1%) and sugar (64.6 and 30.6%). Sorghum was chosen by less than 11% of households in both cities and maize was barely chosen (<1% in both cities). In Ziguinchor, only 5.6% of households ( $n = 24$ ) wished that they could exchange vouchers with other items than those authorized within the program, while they were 38% ( $n = 134$ ) in Dakar-Pikine. The most cited other items that households would have liked to get were butter and chocolate.

Twenty-three percent of households in Dakar-Pikine, and 29% of households in Ziguinchor managed to make savings thanks to the intervention; approximately half of them (58% in Dakar-Pikine and 46% in Ziguinchor) “invested” these savings, mainly in reimbursing debts or in health expenditure. Finally, they were 68.9% households in Dakar-Pikine and 46.2% in Ziguinchor who shared vouchers with family, neighbours or friends (by giving foods exchanged for the vouchers or by inviting people to share their meals).

#### 5 Discussion

The overall state of food security worsened between baseline and endline in both the studied cities and in both non-beneficiary and beneficiary households. This is particularly true for the HDDS and monthly food expenditure, which decreased in all households between the two surveys. In

**Fig. 3** Change in the frequency of consumption of HDDS items in beneficiary and non-beneficiary households between baseline and endline in (a) Dakar-Pikine and (b) Ziguinchor



Ziguinchor however, households who received vouchers were less affected by this general deterioration than households who did not. Using the HFIAS indicator, the risk of being severely food insecure after the intervention was 1.6 times higher in non-beneficiary households compared to beneficiary households. These findings suggest a protective effect of the intervention on household's food security in this city. In

Dakar-Pikine, the intervention had no visible protective effects on any of the food security indicators analysed.

Most unconditional CT programs evaluated in sub-Saharan Africa have resulted in improved household's food security, *via* the purchase of food or the purchase of productive assets (e.g. livestock, agricultural equipment, fertilisers). This was the case in Malawi (Brugh et al. 2018; Miller et al. 2011),

**Table 3** Change in food insecurity indicators between baseline and endline

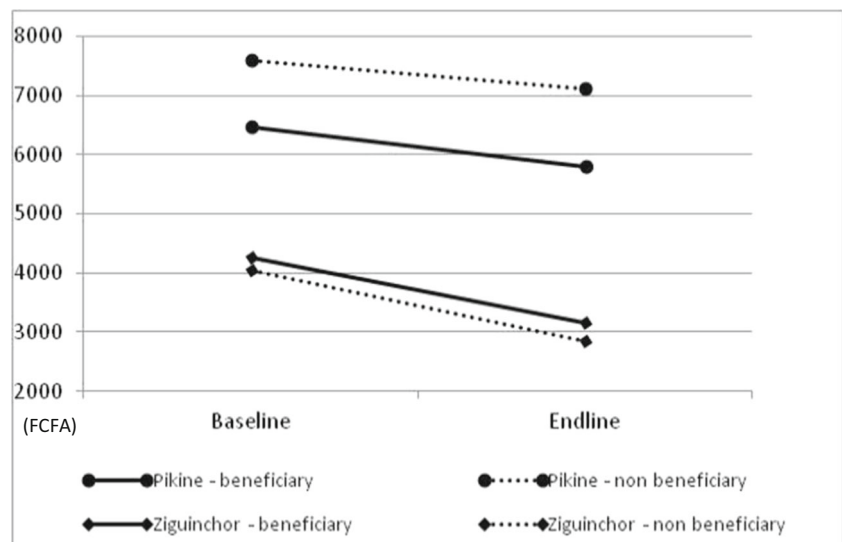
	Dakar-Pikine					p-value <sup>a</sup>	Ziguinchor					p-value <sup>a</sup>
	N	Baseline		Endline			N	Baseline		Endline		
		Mean (SE) or Frequency [95% CI]	OR[95% CI]	Mean (SE) or Frequency [95% CI]	OR[95% CI]			Mean (SE) or Frequency [95% CI]	OR[95% CI]	Mean (SE) or Frequency [95% CI]	OR[95% CI]	
Proportion of severely food insecure households (HFIAS)												
Beneficiary	401	80.7 [75.1–86-.3]	0.9 [0.6–1.5]	80.2 [72.8–87-.6]	0.7 [0.4–1.1]	0.17	428	83.9 [80.4–87-.4]	0.7[0.5–0.9]	64.6 [60.0–69-.1]	1.6[1.2–2.1]	0.0003
Non beneficiary	458	80.2 [72.8–87-.6]		71.6 [64.1–79-.1]			428	77.9 [73.9–81-.9]		73.7 [69.5–77-.9]		
Coping Strategy Index												
Beneficiary	400	21.4 (0.9)		19.5 (0.9)		0.41	429	18.5 (0.6)		18.3 (0.6)		<0.0001
Non beneficiary	458	20.2 (0.9)		17.3 (0.9)			428	16.9 (0.6)		22.5 (0.6)		

<sup>a</sup> P-value for the interaction term (Group x Survey) in mixed models with fixed effects: status of group (beneficiary/non beneficiary), survey (baseline/endline), their interaction (status of group X survey), size of households (only in Dakar-Pikine) and random effects: cluster design effect (only in Dakar-Pikine) and the repetition of measurements in the same households

Ethiopia (Berhane et al. 2011; Debela et al. 2015), Zambia (Schuering et al. 2008; Seidenfeld et al. 2011) and Zimbabwe (Bhalla et al. 2018) for example. CT programs that failed to demonstrate an impact on food security or related indicators usually conjured up irregular, unpredictable payments or low transfer value to explain this lack of impact (Evans et al. 2014; FAO 2014a, b) (Houngbe et al. 2018; Tiwari et al. 2016). The literature on food vouchers and food transfers in sub-Saharan Africa is far less abundant, out of emergency contexts. In the Democratic Republic of Congo, Aker demonstrated that food voucher distributions to

households increased the number of meals per day and decreased the likelihood of suffering from food insecurity (Aker 2013). In Niger and Uganda, this type of intervention resulted in an increase in household's food security as measured by the Food Consumption Score, the Dietary Diversity Index or by the use of fewer coping strategies (Hoddinott et al. 2013). In rural Malawi, Gelli et al. reported a protective effect of food transfers during the lean season on household food security (Gelli et al. 2017).

Program's failure or suboptimal success may be either due to a failure in conception or a failure in implementation, or

**Fig. 4** Change in monthly food expenditure between baseline and endline (in FCFA per adult-equivalent)

both. The food voucher program we evaluated was implemented in a crisis context, where food prices increased sharply. Yet the value of food vouchers was calculated long before the intervention started, and never was readjusted over the course of the program. Setting the suitable transfer amount that will achieve the stated program's objective is essential for any CT program (Davis and Handa 2015). The overall decline in food security indicators we observed may be partly explained by the inadequacy of the amount received to face this crisis, especially in Dakar-Pikine where the cost of living was high. In the meantime, households also had to face the rise in prices related to non-food products (rent, transportation, bills, etc.) which probably further contributed to the reduction in their monthly food expenditure. The fact that households could exchange the vouchers against a limited set of foods (rice, maize, sorghum, cooking oil and sugar) did not permit an increase in household's dietary diversity. Recipients primarily used the vouchers to ensure immediate consumption needs such as rice and oil which are key ingredients of local family meals. The hypothesis of the program was to provide staple foods to households, so that they could save money and purchase nutritious foods such as meat, fish or fruits and vegetables. Clearly this mechanism was not observed, probably due to the generalized increase of food and non-food prices. Other food voucher or food basket programs offering more diverse set of items (including fresh foods or fortified foods) led to improved household or individual dietary diversity (ACF 2012; Aker 2013; Hidrobo et al. 2014; Ramírez-Luzuriaga et al. 2016). In rural Mexico, a food basket distribution significantly increased the prevalence of 6–23 months old children reaching minimum dietary diversity. In Ecuador, a food voucher transfer was combined with nutrition sensitization - through monthly meetings and flyers purposely developed and posted at distribution sites - aimed at influencing behaviour change and increasing knowledge especially with regard to dietary diversity. One can wonder whether integrating an educational component into the intervention (for example recommendations on food items to buy along with the vouchers), or merely offering more diversity of food items would have helped the program achieve its objectives. Nutrient-rich foods such as dried meat, canned sardines or tuna, or milk could have been considered for inclusion into the list of authorized foods to exchange for vouchers without increasing logistical constraints. Moreover, because the program was very short in duration, a non-negligible share of households did not use the vouchers to improve their diet, but rather for other purposes such as reimbursing debts or covering medical expenses.

While there is no doubt that the most needy must be accurately identified for effective poverty and food insecurity alleviation, the way the poorest can be reached is a long-lasting concern. Proxy-mean testing, community-based and geographical targeting are different approaches which have been

proved more or less efficient depending on the contexts (Fortin et al. 2016; Robertson et al. 2014; Stoeffler et al. 2016). In the present study, a community-based targeting coupled with proxy-mean test checking was used to select recipients. Indicators of household well-being (HH dietary diversity, food expenditure and food security) were all extremely low in Ziguinchor, suggesting that very poor households were truly targeted. Despite the well-known poverty of Dakar-Pikine, overall indicator values were not so low (except food insecurity), suggesting that the targeted population could better cope one way or another. Complementary analyses were carried out to further explore the impact of the intervention on the poorest households in Dakar-Pikine, using the lowest quintiles of a household wealth index (calculated by multiple correspondence analysis, based on the household assets, quality of housing and equipment, access to water, and number of people living in the same room at baseline). In the poorest quintiles ( $n = 172$ ), a protective effect of the intervention on HH dietary diversity and food security was noted, similar to the one observed in Ziguinchor ( $p$ -values for interaction = 0.007 and 0.005 respectively, results not shown). While firm conclusions cannot be made from this sub-analysis on a reduced sample of extremely poor households, the trend indicates that the cash-voucher transfer does a better job when reaching the very poor groups.

The intervention was first implemented in Dakar-Pikine, and programmatic difficulties were observed. This included irregularity and unpredictability in distributions (6 distributions in 10 months), which are factors often cited as major contributors to low impact of CT interventions (Evans et al. 2014; FAO 2014a; Handa et al. 2013). Significant program deviation was also observed in Dakar-Pikine. At endline, 56 beneficiary households did not receive vouchers at each distribution, representing 14.2% of the total sample. Among them, 44 households had not received anything. Inversely, 17 households who were supposed to be non-beneficiary actually received some coupons, representing 3.7% of the non-beneficiary households. This may have contributed to the dilution of effect in this city. The experience acquired in Dakar-Pikine was certainly useful to implement the same program in Ziguinchor since none of these problems occurred there. Moreover a larger proportion of households did share the vouchers they received with friends and family in Dakar-Pikine than in Ziguinchor, probably due to higher social pressure, and to lower coverage of the program (estimated at 8.8% in Dakar-Pikine and 28.5% in Ziguinchor).

The evaluation study had some limitations. In Dakar-Pikine the fact that the program targeted the most vulnerable households made the selection of non-beneficiary households challenging. The issue was to find households who were as poor as the beneficiary households, even though they had not been targeted by the program (hence not considered as the poorest). It was decided to select non beneficiary households



from neighbouring districts that were not targeted by the program for ethical reasons, to avoid risks of “contamination” between groups, and because it was deemed that the poorest households would have been selected to receive the vouchers. In these districts, the non-beneficiary households were selected using a process similar to the one used by the program to select the beneficiary households (list of the most vulnerable households provided by a local committee and based on predefined criteria), except the post-identification checking that could not take place because of logistical and financial constraints. The final strategy consisted of doubling the sample size of non-beneficiary households so that half of them – the most comparable to beneficiary households using propensity matching – could be selected for impact evaluation. This strategy appeared to be efficient except for the monthly food expenditure, which was higher in non-beneficiary household compared to beneficiary households at baseline. This was nevertheless the best strategy we could use in the absence of random assignment to experimental and control groups. In Ziguinchor the sampling procedure was more straightforward because all districts were considered as poor and were therefore targeted by the program. Non-beneficiary households were directly and randomly selected from a complementary list of poor households provided by the local committee. Larger sample size may have allowed to detect more significant changes between groups.

The indicators for household food security and well-being worsened between baseline and endline in both cities and in both groups of households, due to the economic and price crisis that occurred during the intervention. The pilot distribution of food vouchers alleviated some effects of the crisis in Ziguinchor, but not in Dakar-Pikine. In the latter city, more regular transfers, adjustment of transfer size over time and/or targeting the extreme poor may have helped the program meet its objectives.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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