AIMS Agriculture and Food, 8(2): 598–614.
DOI: 10.3934/agrfood.2023033
Received: 01 November 2022
Revised: 06 February 2023
Accepted: 17 February 2023
Published: 24 May 2023

http://www.aimspress.com/journal/agriculture

Research article

Access to special COVID-19 relief from distress grant and livelihood outcome of livestock farming households in Eastern Cape Province, South Africa

Seyi Olalekan Olawuyi* and Abbyssinia Mushunje

Department of Agricultural Economics & Extension, University of Fort Hare, South Africa

***Correspondence:** Email: SOlawuyi@ufh.ac.za, seyidolapo1704@gmail.com; Tel: +27640333235.

Abstract: Unexpected events and shocks constitute greater threats to the attainment of zero hunger targets in Africa and the world over, and in the extreme case, lead to total collapse of the global food system and food supply chain. Consequently, this causes significant loss of critical income sources, renders individuals vulnerable, and further deteriorates households' livelihood outcome and welfare state. Therefore, the need for social protection programs to mitigate the impact of distress and unexpected events, as well as extreme occurrences cannot be over emphasized. This research used dataset from the 1499 households captured in the 2021 South African General Household Survey to investigate whether access to a special relief from distress grant has effect on the livestock farming households' food security status in Eastern Cape Province of South Africa. Descriptive statistics, cross-tabulation, a two-sample t-test, a food insecurity experience-based scale technique, and a fractional outcome model were used to analyze the datasets. Based on access to the grant, households in the non-beneficiary group are significantly distinguishable from the beneficiary counterparts, such that the beneficiary households out-performed the non-beneficiary households in the food break-even and food surplus categories. The findings further indicated the possibility of transition of the beneficiary households' population under the transitory food insecurity category to either the chronic food insecurity status or food break-even status, subject to the effectiveness of the food security policy to which they are exposed. The fractional outcome model also indicated that non-metropolitan resident households ($p < 0.05$), access to the special grant ($p < 0.01$), access to health facilities ($p < 0.01$), age of households' heads ($p < 0.01$), colored, indian and white population groups (both at $p < 0.01$), as well as access to remittance ($p < 0.01$) made significant

contributions to the households' food security status. The Wald test indicated that access to the special relief grant had a significant effect on the households' food security status in the study area. The study therefore recommends accelerated investments in various social investment programs as sustained responses to expected and unexpected shocks and occurrences to be able to induce progress and realize more resilient food systems.

Keywords: relief grant; food security; livestock farming; FIES; fractional logistic model; Eastern Cape Province; South Africa

1. Introduction

Livestock production is an integral part of human sustenance through its contribution to the agri-food system, general households' income, and in particular, food security and food sovereignty [1]. In agricultural development policies, food security and food sovereignty are entwined in nature, and they both focus on strategies to improve food productivity to meet immediate and future demand for food [2,3].

Food security deals with the physical, social and economic access of individuals to sufficient, consistent, healthy and nutritious diets which satisfy their dietary requirements, as well as their willingness to maintain a healthy lifestyle [4]. On the other hand, food sovereignty is concerned about individuals, people, or the community's right to healthy and culturally suitable food, cultivated using sustainable and ecologically sound approaches. It also highlights the right of people or a community to independently define their own food and agriculture system [5].

Developing countries including South Africa are faced with the problem of sustained production in the livestock sub-sector as a result of demand surge for livestock products [6]. This is further worsened by several production risks and challenges such as extreme climate events [7], and not long ago, the global health challenges of the COVID-19 pandemic [8]. Specifically in Africa, the incidence of COVID-19 and the surge of cases have raised concerns about the sustainability of the food systems, while the prolonged paralyzed economic activities have substantially led to contraction in the economies across nations [8]. This situation puts livelihoods and survival at risk, because in almost certain likelihood, what this apparently suggests is that COVID-19 and the associated livelihood and economic challenges significantly impact the African food system and food sovereignty, leading to food and balanced nutrition crisis across the continent. Therefore, the sustainability of livestock production systems is very important.

Sustainability in this sense is the capability to match up with the demand for livestock products at the moment without affecting future demand and supply [9]. To achieve increased and sustained productivity in the livestock sub-sector, the government needs to mitigate the current challenges through adequate financing of the sector to reduce hunger, and to meet the long-run economic, social and environmental obligations [9]. On this premise, long term planning necessitates creative effort because the pandemic has worsened the fragility of the agri-food sector to the looming food and nutrition crisis in terms of production, availability, and distribution for consumption. Life after COVID-19 situations in Africa will require the continent to invest robustly in the agri-food sector, put in place an actionable rural development policy to drive the sector, and to achieve sustainable food production, especially in the livestock industry [8]. In the light of this, supportive government

interventions in the agri-food systems transformation will certainly play a defining role. This gesture has been demonstrated by the South African government by instituting a COVID-19 intervention fund (also known as COVID-19 agricultural disaster fund) of about R1,2 billion, which was set aside as an agricultural disaster package to address the negative externalities of the pandemic on food in a bid to ensure sustainable food production in the country [10]. To date, R500 million has been approved for the smallholder and communal farmers where each of the approved beneficiary farmers were eligible to receive farm inputs up to a maximum value of R50,000 based on the scale of their farming operations. Interestingly, smallholder livestock farmers applied the most, as stated by the Minister of Agriculture, Land Reform and Rural Development [10]. It is important to reiterate that the disbursement of intervention funds to the beneficiary farmers was premised on some eligibility conditions, which presented a challenge to some farmers in accessing the fund. These selection criteria, according to the South African Department of Agriculture, Land Reform and Rural Development [10] as cited by Popoola and Yusuf [11] are as follow:

- Completed application form for intervention fund request,
- South African Certified ID copy, which should not be older than 3 months,
- Having a minimum turnover of R20,000 per annum but not exceeding R1 million, of which the farmers must produce evidence through a financial statement or financial records.
- Valid confirmation of land tenure/ownership, in the form of title deeds, tribal resolution, permission to occupy, or a minimum of 5 years lease agreement,
- Evidence of existing farming operation for more than a year,
- Farming operation able to create permanent and/or seasonal jobs,
- Presentation of certificate of Environmental Impact Assessment where such is needed for the operations,
- Proof of access to water (borehole or other sources) for irrigation in the case of vegetables, fruits and winter crops farming, which should also be backed up by water license/rights or proof of application for that such license had.

In South Africa, livestock production remains the leading enterprise, where the majority of the agricultural households engage in animal farming [12]. According to Oduniyi, Rughara and Antwi [9,13], livestock activities in South Africa are more pronounced in the Eastern Cape, KwaZulu Natal, Free State, and Northwest provinces of the country. The Beef cattle production accounts for about 80% of the national herd with dairy accounting for 20%, and approximately 60% of the beef cattle production in South Africa is controlled by the commercial farmers, while the remaining 40% are owned by the emerging sector [9,13].

In addition, Marchant-Forde and Boyle [14], as well as Oluwatayo [15] averred that livestock production is a promising enterprise, and that any disruption (both internal and external) in the production chain and flow will not only have consequences on the production output, but will also upset consumers' food accessibility, and aggravate the already worsened situation.

Evidently, this is a pointer to the fact that, livestock industry in South Africa is very important, just like all other sub-sectors in the agricultural sector; and this is a wakeup call to all other African governments to emulate. Suffice it to say that, short- and medium-term responses to mitigate the impact of COVID-19 on the agri-food sector must genuinely lead to increased production to meet the Africa's growing demand, with about 1.2 billion individuals at present and is projected to exponentially increase by the next three decades [8].

Thus, this study investigated the impact of a special relief of distress grant and/or intervention

on the livestock farmers' livelihood outcome in the Eastern Cape Province of South Africa. Importantly, the study indicated that there is no direct relationship between access to the special relief from distress grant and food security status in the study area. More so, this research was guided by the following research questions:

- Are there any differentiated socio-economic and demographic features based on access to the special relief from distress grant among the households in Eastern Cape Province of South Africa?
- What is the status of the livelihood outcome of both the beneficiaries and non-beneficiaries of the special relief from distress grant in the study area?
- Is there any impact of farmers' access to the special relief from distress grant on the livelihood outcome of both livestock and non-livestock farming households in the study area?

1.1. Theoretical perspective and literature review on food security

Food security stands on a tripod stand involving three important components which are food adequacy (which is made up of food availability and stability), food access through sustained supply and adequate utilization for nutritional needs. Exploring the theories associated with food security, the application of Neo-Malthusian theory comes into play, and this theory posits that there is a fundamental association between sustainable development and food security [16]. In the real sense, food security is a complex issue requiring an integrated approach and multiplicity of theories to have a full understanding because it will continue to be a major issue insofar as the challenges of hunger persist [16]. It is therefore important to also integrate the social, institutional and the economic causes of food insecurity to complement the other notable perspectives on the population growth in order to guide the development experts towards understanding food security problems in terms of access and deprivation [16]. Applying a theoretical, comparative, and conceptual sociological tools can give an in-depth understanding of how food security problems can be addressed; therefore, sociological theory, as adopted by this study is in a good position to explain this concept owing to its flexible nature, and ability to utilize an interdisciplinary approach. From the perspective of a literature review, Shahzad et al. [17] in their study noted that many people are struggling with poverty and hunger, and this situation is even compounded by the current health challenges of the COVID-19 pandemic. Even though the policy measures (restrictions on movement and transportation, physical distancing, quarantine, etc.) put in place for the containment of COVID-19 have had positive effects, they still have social, health, psychological, and economic consequences, and are also counter-productive [18]; this apparently resulted in income fluctuation and reduction, as well as massive unemployment. Food systems have been badly affected by the impact of the COVID-19 shock, and this scenario also presented an unexpected challenge with profound social and economic costs, including compromising food and nutrition security [18]. In fact, households' access to food is dependent on the level of individuals' disposable income and the available resources at their disposal. Meanwhile, their ability to access and purchase food is significantly reduced if the income of the resource poor or marginalized individuals is badly impacted because shocks or disaster affect people's economic ability to access food, and this obviously aggravates food insecurity situations [17]. Given this condition, vulnerable individuals take to self styled coping mechanisms, and in some cases, rely on financial assistance in the form of relief interventions from government agencies and development organizations, to mitigate any effect of shocks or stressors on the food systems.

2. Description of the study area

2.1. Description of the study area

This study was carried out in the Eastern Cape Province of South Africa, as depicted in Figure 1. Of all of the provinces, documented evidence indicated that Eastern Cape Province is the second largest, and it covers an area of approximately 169,966 km², constituting about 13.9% of the total land area [19]. The population of the province is more than 6.7 million people, mostly dominated by the isiXhosa speaking group, followed by English and Afrikaans, and then other minority population groups such as Indians and other Asians [20]. Agriculture is the main source of livelihood in the area, and more importantly, livestock farming is highly pronounced (about 49.7%) in the study area [21], compared to other provinces in South Africa. There are also some inhabitants of the study area who engage in other off-farm and non-farm activities [19,22].

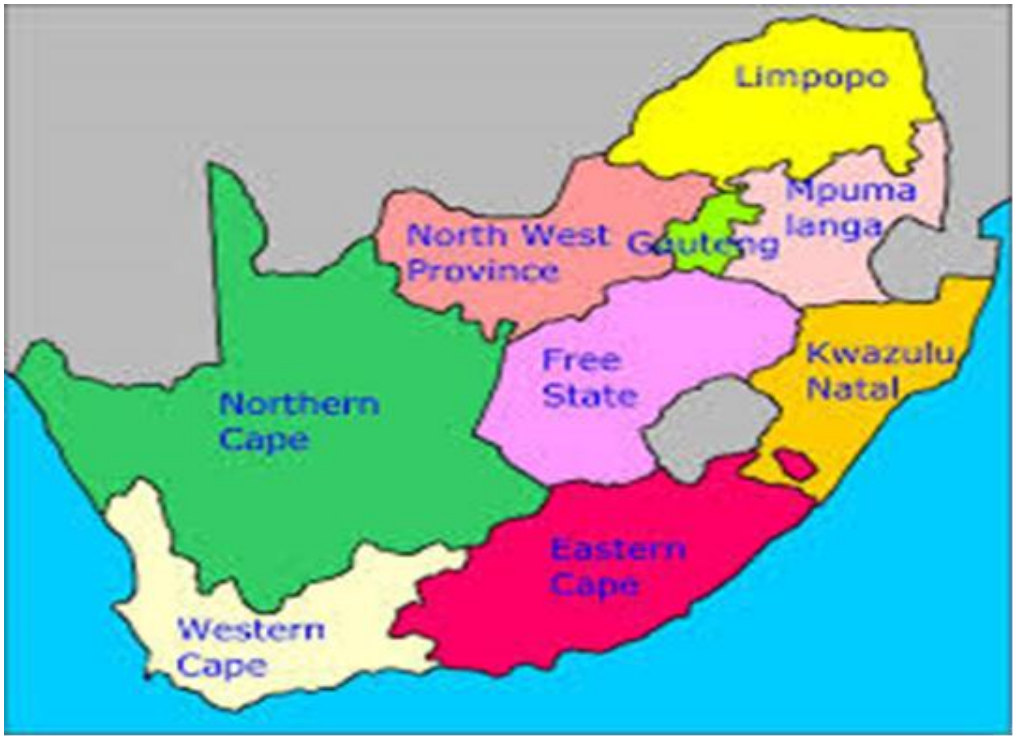

Figure 1. Map of South Africa showing all the provinces, including Eastern Cape Province. Source: https://www.southafrica.to/provinces/provinces.php [23].

2.2. Source and description of data

This research used the latest dataset from the 2021 South African General Household Survey (GHS) conducted by Statistics South Africa (Stats-SA), and accessed through the Data-First data portal of the University of Cape Town in South Africa. Secondary stratification was carried out based on some specific attributes related to the population and geographical (urban, tribal and farms) dynamics in the selection of samples from the provinces across South Africa; and this was made possible during the survey with the help of the country's population census data. In specific terms,

stratified random proportionate proportional-to-size and systematic sampling techniques were applied simultaneously in two stages to select the primary sampling units and dwelling units which also trickle down to individuals, respectively [21].

The GHS is a yearly survey exercise, designed to gauge the South Africans' (individuals and households) living conditions and circumstances. The scope of the GHS covers both household (*all de jure household members*), and individual levels. It is important to mention that the household-level dataset was used for this research and efforts were made to clean up the dataset to prevent any possibility of outliers before analyzing the dataset. The datasets captured the following: "personal and socio-demographic characteristics-relationship to household head, marital status, language, literacy status, employment, food security information, and agricultural practices, household assets, housing conditions-dwelling type, dwelling ownership, access to basic services and functionality of the facilities in terms of health conditions-access to health care, safe water, sanitation, fertility, mortality, disability, as well as social investment program-access to social grants, including the special relief grant" [21].

2.3. Methods of data analysis

Descriptive statistics (such as, frequency distribution, percentages, mean values, cross-tabulation) and Two-sample t-test (Welch) were used to describe and profile the households' socioeconomic and demographic features, as well as to explain the beneficiary and non-beneficiary households' differences in food security status and socio-demographic characteristics based on their access to the special relief grant.

Conceptually, this research also adopted the use of food insecurity experience-based scale (FIES) approach for the assessment of households' food security vis-à-vis food insecurity status in the study area [24–28]. In particular, the FIES approach is normally used to assess and capture the range of experiences of food insecurity at the individual or household level [24]. The approach involves eight questions, which are internationally validated, that are used to measure the severity of food insecurity [24]. In essence, this approach uses a theoretical construct of food insecurity built on ethnographic research that shows the universality of food insecurity experiences. Importantly, this method is a clear deviation from the usual application of the Foster-Greer--Thorbecke (FGT) technique of measuring the food security status of an individual. The FGT technique uses per capita consumption expenditure and/or an income approach to estimate individual's food security status which is vulnerable to outliers due to individuals' quantitative recall of monetary metrics through memory estimates, as well as intentional misinformation by the farmers. Hence, we opted for adoption of the FIES measure of food security status.

The food security and/or insecurity status of individuals is assumed to be an unobservable construct or a latent variable [29]; and in line with the item response theory [24,29], the FIES approach adopts a theoretical construct of food security and/or insecurity from an ethnographic perspective, and this approach also established the universality of food security or insecurity experiences, as validated through the Gallup WorldPoll.

The FIES approach permits categorization ofthe scores generated from the item response questions into the following continuum of food security/insecurity status: chronic food insecurity, transitory food insecurity, food break-even and food surplus, depicting the actual state of the households' food security status in the study area. While the first two categories can also be referred

to as the "food secure group", the last two categories represent the "food insecure group" [27,28]. In addition, the food security/insecurity index was computed from the food inexperience-based score through min-max normalization technique, and this is necessary because of differentiated weights attached to each level of food security/insecurity status, which are generated from the scores obtained from the item response questions. Likewise, a cross-tabulation technique was used to examine the status of livelihood outcome of both beneficiaries and non-beneficiaries of the special grant relief package in the study area, and a fractional outcome model (with the appropriate post-hoc test) was applied to estimate the effect of farmers' access to the relief from distress grant on the livelihood outcome of households' in the study area. The Wald test was also used to investigate if a direct relationship exists or not, between access to the special relief grant and food security status.

2.3.1. Fractional outcome model

The econometric modeling of bounded dependent variables presents thorny challenges, especially for non-binary variables with a significant number of observations at the extremes. The fractional outcome model which is also known as the fractional response model was put out by Papke and Wooldridge [30], and the model provides a robust approach to deal with the challenges posed by bounded dependent variables. The fractional outcome model overcomes many limitations of established linear and non-linear econometric solutions and has been extensively used in economics and public policy. Bounded response variables present peculiar distributional properties; as a result, in most cases such variables are not amenable to linear regression models.

The model also represents a viable solution to address many of the econometric limitations (which can lead to biased, imprecise and spurious estimates) that are found in the non-linear solutions currently utilized to model bounded dependent variables [31]. The model is also an extension of the generalized linear model to a class of functional forms that circumvent most of the known issues of the traditional econometric models for bounded variables. According to Gallani et al. [31], the fractional outcome model accounts for the bounded nature of the dependent variable from both above and below, predicts response values within the interval limits of the dependent variable and captures the non-linearity of the data, thereby yielding a higher fit compared to linear estimation models.

Furthermore, the model does not require special data transformations at the corners and permits a direct estimation of the conditional expectation of the dependent variable, given the predictors [31]. The estimation of the model's parameters is based on a quasi-maximum likelihood method, which generates fully robust and relatively efficient estimates under generalized linear model conditions [30].

Papke and Wooldridge [30] as cited by Oberhofer and Pfaffermayr [32] considered the following model for the fractional response variable:

$$E(y_i|\boldsymbol{x}_i) = G(\boldsymbol{x}_i\boldsymbol{\beta}), i = 1, \ldots, N, \qquad (1)$$

where $0 \leq y_i \leq 1$ denotes the dependent variable; y_i refers to the dependent variable (food security index) of observation *I*; $\boldsymbol{x}_i$ refers to the explanatory variables of observation *I*; $\boldsymbol{\beta}$ is the regression coefficient; *G*(.) is a distribution function similar to the logistic function (using logit as the estimator).

More importantly, marginal effect test statistics were computed (as post-estimation analysis) to

determine if the coefficients are significantly different from zero. According to Williams [33], the Wald test performs better than the likelihood ratio (LR) tests, owing to the fact that LR tests are problematic when it comes to robust standard errors which are associated with the fractional regression models.

3. Results and discussion

3.1. Differentiated socio-economic characteristics and food security status of the beneficiaries and non-beneficiaries of special COVID-19 relief from distress grant in the study area

A student's t-test is an appropriate tool, suitable to test the null hypothesis that the means of the two groups (beneficiaries and non-beneficiaries) are the same based on households' specific attribute. Therefore, a two sample t-test conducted to determine if access to the special relief grant by households leads to a difference in their food security revealed that the mean food security status was significantly different between the two groups (beneficiaries and non-beneficiaries) ($t = -6.2769$, $p < 0.01$). The results suggest that, on average, the beneficiaries of the special relief grant performed slightly better in terms of food security status than the non-beneficiaries by a margin of 0.06. Given the computed t-test statistics ($t = 7.7467$, $p < 0.01$), the non-beneficiaries outperformed the beneficiary group by a margin of 0.67 in terms of the total monthly income; a reasonable explanation for this could be related to the non-immediate gains associated with agricultural investments which the beneficiaries of the special grant might have made. With reference to the gender of the household head, the results also indicated that on the average, male-headed households among the non-beneficiary group performed significantly ($t = 8.9117$, $p < 0.01$) better than the counterparts in the beneficiary group by a margin of 0.24. This counter-intuitive result is surprising because access to the grant is expected to have an impact on beneficiary households, but this deviation could perhaps be a result of inappropriate use of the grants received by the male-headed households in the beneficiary group.

As far as age of the household heads is concerned, the beneficiary group, on average, outperformed their counterparts in the non-beneficiary group, significantly ($t = -15.3228$, $p < 0.01$) by a margin of 12.02, suggesting that the mean age was widely different between the two groups; this might also be responsible for the difference in their access to the special relief grant. The logical explanation for this observation could be the prevalence of vulnerable older individuals within the beneficiary group, who satisfied the conditions to access the relief grant, while the counterparts in the non-beneficiary group did not meet the conditions to access the relief grant.

More importantly, on average, households who are involved in livestock farming in the beneficiary group significantly performed ($t = -8.5107$, $p < 0.01$) better than the counterparts in the non-beneficiary group by a margin of 0.16 in terms of access to the special relief grant. This result is as expected because Eastern Cape Province is known for livestock production in South Africa, and any policy enhancing action on the livelihood outcomes is expected to have notable impact in this area of agricultural production in the province. The same pattern of result was observed for households' involvement in agriculture as a primary occupation, and the results equally showed that the special relief grant recipient households whose primary occupation is agriculture significantly ($t = -8.9568$, $p < 0.01$) differ by a margin of 0.23 from the counterparts in the non-beneficiary group. By implication, the finding suggests that involvement in agriculture and access to the social relief

grant are mutually enhancing and reinforcing.

The results also indicated that, on average, households in the non-beneficiary group are significantly distinguishable (t = 2.3036, $p < 0.05$) from the grant recipient households group, in terms of having other sources of income (livelihood diversification). From the results, the non-beneficiary households with multiple income sources appeared slightly better-off than the counterparts in the beneficiary group, by a margin of 0.01. Consistent with a priori expectation, and given the computed t-test statistics (t = -6.1696, $p < 0.01$), the results also indicated that on average, grant recipient households who were domiciled in the metropolitan geo-locations in Eastern Cape Province of South Africa performed excellently well by a margin of 0.16, compared to the counterparts in the non-beneficiary group who were domiciled across the non-metropolitan geo-locations. This result is in tandem with expectation, because households within the metropolitan locations are assumed to be at an advantage in terms of diverse livelihood portfolios where the relief grants can be channeled for investments.

Given the means of the two groups, the findings evidently revealed that the beneficiary and non-beneficiary households have differentiated socio-economic and demographic features based on access to special relief from distress grant.

Table 1. Two-sample t-test: Access to special relief grant with food security status and households' socio-demographic characteristics.

Variables	Mean (pooled) (N = 1499) (100.0)	Non-Beneficiaries (N = 432) (28.82%)	Beneficiaries (N = 1067) (71.18%)	Mean Difference	t-value
Food security status	0.2584	0.2115	0.2774	-0.06	-6.2769*
Log of total monthly income	8.243	8.727	8.0516	0.67	7.7467*
Gender of household head	0.4689	0.6435	0.3983	0.24	8.9117*
Age of household head	55.1214	46.5601	58.5876	-12.02	-15.3228*
Engagement in livestock farming	0.2194	0.0995	0.268	-0.16	-8.5107*
Primary occupation	0.4096	0.2453	0.4761	-0.23	-8.9568*
Livelihood diversification	0.014	0.0277	0.0084	0.01	2.3036**
Metropolitan	1.7178	1.59	1.76	-0.16	-6.1696*

Note: * - $p < 0.01$; ** - $p < 0.05$ - probability levels respectively; mean difference was computed by two-sample t-test with equal variances (welch); Source: Data analysis, 2022.

3.2. Status of livelihood outcome (food security status) of both beneficiaries and non-beneficiaries of the special relief from distress grant

The cross-tabulation analysis of households' food security status (expressed in categories) based on their access to the special relief grant is indicated in Table 2. From the results, 4.9% and 7.2% of the non-beneficiary and beneficiary households respectively, were found in the chronic food insecurity status category, while 4.9% and 13.8% of the non-beneficiary and beneficiary households respectively, fell under the transitory food-insecurity status category. Conversely, more than half (52.7% and 56.4%) of both the non-beneficiary and beneficiary households, respectively, were found in the food break-even category, while 37.5% and 33.6% respectively, were found in the food surplus category.

Consistent with what Stats-SA [34] also reported, Eastern Cape is the sixth least vulnerable Province in terms of hunger, of all the Provinces in South Africa. The implication of the results is that beneficiary households out-performed the non-beneficiary households in the food break-even and food surplus categories, given their respective populations in the category of food security status. This is expected because the beneficiary households enjoyed access to the relief grant. Another notable revelation from the results is that chances are high that the beneficiary households' population under the transitory food insecurity category will experience transition from their current food security status to either chronic food insecurity status or food break-even status, subject to the institutionalization and implementation of appropriate food-security policy measures by the government and development experts. Apparently, this also suggests that if good food policy measures are put in place, the better, but if not, the beneficiary households' populations in the transitory food insecurity status category are most likely to be vulnerable to chronic food insecurity status. One can say that there is a significant difference between the beneficiary and non-beneficiary farmers in terms of food security status, which further gives credence to the observation on food-security status that was highlighted earlier in Table 1.

Table 2. Food security status of beneficiaries and non-beneficiaries of special relief grant.

Households' food security status	Non-beneficiaries (N = 432)	Beneficiaries (N = 1067)	Total (N = 1499)
Chronic food insecurity	21 (4.9)	77 (7.2)	98 (6.5)
Transitory food insecurity	21 (4.9)	147 (13.8)	168 (11.2)
Food break-even	228 (52.7)	602 (56.4)	830 (55.4)
Food surplus	162 (37.5)	241 (22.6)	403 (26.9)

Note: Figures in parentheses are percentage values; Source: Data analysis, 2022.

Table 3. Food security status of non-livestock and livestock farming households.

Food security status	Non-Livestock Farming (N = 1170)	Livestock Farming (N = 329)	Total (N=1499)
Chronic food insecurity	77 (6.6)	21 (6.4)	98 (6.5)
Transitory food insecurity	118 (10.1)	50 (15.2)	168 (11.2)
Food break-even	651 (55.6)	179 (54.4)	830 (55.4)
Food surplus	324 (27.7)	79 (24.0)	403 (26.9)

Note: Figures in parentheses are percentage values; Source: Data analysis, 2022.

3.3. Livelihood outcome (food security status) of livestock and non-livestock farming households

The results in Table 3 also revealed the food security situation of the livestock and non-livestock farming households in the study area. The results indicated that the majority (54.4%) of the livestock farming households were found in the food break-even category, while close to one-fifth (24.0%) of the livestock farming beneficiary households were also found in the food surplus category. These observations could perhaps be attributed to their access to the relief package. More so, the livestock farming households were also found to be vulnerable to transitory and chronic food-insecurity situations. By implication, this result further validates what was reported earlier about the state of food security vis-à-vis food insecurity among the beneficiary and non-beneficiary households who

are involved and not involved in livestock farming in the study area. Conversely, 55.6% and 27.7% of the non-livestock farming households were found in the food break-even and food surplus categories, respectively, while small proportion (10.1% and 6.6%, respectively) were also found in the transitory and chronic food insecurity situations, compared to the population of livestock farmers in those categories of food security status. This suggests that non-livestock farming households appeared to be better off in terms of food security status compared to their counterparts.

3.4. Farmers' access to special relief from distress grant and livelihood outcome of livestock farming households in Eastern Cape Province of South Africa

The effects of the special relief grant and intervention on households' food security status was estimated through fractional logistic model, and the findings revealed the significant variables that influence households' food security status in different directions. The results indicated that non-metropolitan resident households, access to the special grant and access to health facilities have direct relationships with the households' food security status. Conversely, the age of households' heads, ethnicity/race, as well as access to remittance have inverse relationships with the households' food security status in the study area.

By implication, the margins estimate of the nonmetropolitan resident households indicated that, on the average, for every unit increase in the household being a nonmetropolitan resident, the likelihood of being food secure significantly ($p < 0.05$) increases by 17.26 points, *ceteris paribus*, which is in tandem with what Stats-SA [35] reported that those in urban areas are more vulnerable to hunger than those in the rural areas. This also suggests that in the nonmetropolitan areas, perhaps rural in nature, there seems to be easy availability, accessibility of food, and relative affordability of food items by the households; possibly, because of the proximity to farm settlements, the food items may not be as expensive as what is obtainable in the metropolitan areas due to transaction costs involved from the farm to the point of sales.

More importantly, the margins estimate of access to the special grant pointed to the fact that, on average, the likelihood of households being food secure significantly ($p < 0.01$) increases by 26.64 points for every unit increase in access to the special grant. This is expected and in line with a priori expectation because access to the special grant, being a social investment program is expected to contribute positively to the welfare of the households, all else being equal. This finding disagrees with Mbewana [35], who reported that the largest proportion of the food secure population was found among the households who are not social grant recipients. However, the result is perfectly consistent with the report of Stats-SA [34], which states that the main source of income for the households in Eastern Cape is the social grant, and as such it contributes to their food security status.

In terms of access to health facilities, the margins estimate indicated that on average, a unit increase in access to health facilities will likely and significantly ($p < 0.01$) increase the chances of the households of being food secure by 40.64 points. This result is also expected because only healthy individuals can indeed be productive, and likely be food secure, given the laborious nature of farming operations. The finding is in line with the submission of Ngumbela, Khalema and Nzimakwe [36] who stated that farmers' health status has a direct impact on agricultural productivity and food security. On the other hand, the margins estimate of the age of households' heads indicated that on the average, for every unit increase in the age of households' heads, the likelihood of being food secure significantly ($p < 0.01$) reduces by 0.93 points. A logical explanation for this is of aging,

given that individuals tend to obey the life cycle hypothesis of decline in productivity level as aging sets in with time, which is also in tandem with the human capital theory which posits that as people age, productivity may likely be growing at a decreasing rate. This result is in tandem with the submission of Kahsay and Mulugete [37] as well as Masuku, Selepede and Mtyingizane [38] who also found that younger household heads were more food secure than the older household heads counterparts.

Table 4. Effects of the special relief from distress grant on households' food security status.

Food security status	*Coefficients*	*Average marginal effects* (*dy/dx*)	*Z-value*	*P* > |*Z*|
Constant	-1.1463	-	-	-
Gender of household head	-0.013	-0.0024	-0.24	0.814
Age of household head	-0.0093	-0.0017*	-4.74	0
Population group (African/Black- Base)				
Coloured	-0.3685	-0.0644*	-2.8	0.005
Indian/Asian	-0.5914	-0.0973*	-8.96	0
White	-0.369	-0.0645*	-4.6	0
Metropolitan (Metro - Base)				
Non-metro	0.1726	0.0319**	2.4	0.016
Household size	0.0015	0.0002	0.13	0.894
Engagement in livestock farming	0.0082	0.0015	0.12	0.907
Access to special grant	0.2664	0.0502*	3.26	0.001
Access to health facilities	0.4064	0.0766*	5.4	0
Access to remittance	-0.2341	-0.0441*	-3.37	0.001
Livelihood diversification	0.1686	0.0317	0.67	0.5

Note: *dy/dx* for factor levels is the discrete change from the base level; *, ** - $p < 0.01$ *and* $p < 0.05$ respectively; Source: Data analysis, 2022.

Similarly, the margins estimates of being in the Colored, Indian/Asian, or White population groups suggested that a unit increase of belonging to any of these population groups by households, compared to the African/Black population group, will significantly (all at $p < 0.01$) reduces the chances of being food secure by 36.85 points, 59.14 points and 36.9 points respectively. The implication of the finding is that the African/Black population seemed to be more food-secure than their counterpart population groups in the study area. A plausible explanation for this could be access to the social relief grant by most of the African population, as evidenced in the report of Stats-SA [34].

In a similar manner, the margin estimates of access to remittance indicated that, on average, the likelihood of households being food secure significantly ($p < 0.01$) reduces by 26.41 points for every unit increase in access to remittance. A possible reason for this deviation could perhaps be attributed to a situation of remittance recipient households obeying Say's law, which states that everything produced is consumed without investment. In this case, households might have used such remittance on frivolities instead of investing it in productive engagements. All else equal, this finding is contrary to expectation, because similar studies(for instance, [35,38,39]) reported a direct and significant relationship between access to remittance and the food security status of individuals.

All in all, the findings in this study especially in the aspects of food security and social grants, are in tandem with some results by Ngumbela et al. [36], who was reported in their study conducted

in Eastern Cape that food insecurity in rural areas, either at the individual or household level, is best addressed through sustained food productivity, which by extension is only realizable through a good health care system and social relief from distress interventions. More so, given the nature of the study area, a social relief grant is important to the welfare of the households in Eastern Cape Province of South Africa, and this had earlier been affirmed by Stats-SA [34], which reported that social relief assistance represents a major income source for the inhabitants of Eastern Cape, and that this invariably has a direct impact on their food security status.

3.5. Hypothesis testing

The null hypothesis is that there is no direct relationship between access to the special relief from distress grant and households' food security status in the study area. Given the result of the Wald test indicated below, it is evident that a direct and significant relationship (10.66 @ $p < 0.01$) exists between access to the special relief from distress grant and food security status of the households in the study area. Since this is so, this study aligns with the alternative hypothesis.

[fdsecindx]accgrant_hh = 0

$chi^2(1) = 10.66$

$Prob > chi^2 = 0.0011$

This research went further to test if the amount of the special grant received by households has any effect on their food security status, and the finding equally validates the earlier reported result. Likewise, in this case, evidence of a linear and significant relationship (6.98 @ $p < 0.01$) between the amount of the special relief grant received and households' food security status in the study area, was established. This therefore allows us to infer that access to the special relief grant indeed has an impact on the households' food security status in Eastern Cape Province of South Africa.

[fdsecindx]lntotalgrnt_hh = 0

$chi^2(1) = 6.98$

$Prob > chi^2 = 0.0082$

4. Conclusions and recommendations

This study interrogated the impact of access to the special relief intervention grant on the livelihood outcome of the households in Eastern Cape Province of South Africa. Given the dimension of various findings, it is evident that beneficiary and non-beneficiary households are significantly different in terms of sociodemographic characteristics, and food security status based on their access to the special relief from distress grant. The households across both groups were also disproportionately spread across the four levels of food security status in the study area. The study also concluded that if proper food policy interventions are not made to better the living condition of the households, there is a high possibility of a transition of households from their current food security situation to a more pitiable food insecurity situation. In addition, the study found that nonmetropolitan resident households, access to special grant, access to health facilities, the age of households' heads, population group, and access to remittance influence households' food security status in the study area. In all, there is a need for accelerated investments in social investment programs that focus on skill development and the provision of a social safety net through formal and informal transfers which can provide a buffer against food-insecurity situations. This also represents

a sustained response to expected and unexpected shocks and occurrences, as well as a way to promote progress toward having a more resilient food system, offer better protections and improve the livelihood outcomes of the resources poor individuals, especially the resource-poor farming households in the study area.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Authors' Contributions

Dr. Olawuyi, Seyi Olalekan: Conceptualized the research, developed the research objectives, wrote the sections of the manuscript, analyzed the data, and interpreted the results.

Prof. Abby Mushunje: Jointly conceptualized the research, developed the research objectives, supervised the research, validated the results reported, corrected and approved the manuscript.

Ethical Considerations

The study utilized a secondary dataset from South African government establishment (Stats-SA), and the data collection process adhered strictly to research ethics, which are also in line with the following University of Fort Hare Research Ethics Committee's standard ethical practices and considerations: anonymity, informed consent, privacy, confidentiality and professionalism, as outlined in the World Health Organization's Declaration of Helsinki [40] on research protocol. The research ethical clearance number is: REC-270710-028-RA Level 01.

Acknowledgments

The authors acknowledge the support of Govan Mbeki Research and Development Centre (GMRDC), University of Fort Hare (UFH), South Africa, for providing an enabling environment, academic resources and funding for the research and publication of this article. The authors also appreciate Statistics South Africa (Stats-SA) for the GHS data collection and the University of Cape Town, South Africa, which made the data freely available through its Data-First portal.

Conflict of interest

The authors declare no conflict of interest.

References

1. Meisnner H, Scoltz M, Engelbrecht F (2013) Sustainability of the South African Livestock Sector towards 2050 Part 2: Challenges, changes and required implementations. *S Afr J Anim Sci* 43: 298–319. https://doi.org/10.4314/sajas.v43i3.6

2. European Commission (2015) Global food security: Challenges and options. European Union Agricultural Markets Briefs 9. Available from: https://www.fao.org/family-farming/detail/en/c/357441/.
3. Borras AM, Mohamed FA (2020) Health inequities and the shifting paradigms of food security, food insecurity, and food sovereignty. *Int J Health Serv* 50: 299–313. https://doi.org/10.1177/0020731420913184
4. Penner S, Kevany K, Longboat S (2019) Indigenous food sovereignty 658 in Canada: Policy paper. Building rural policy through international comparative analysis. Rural policy learning commons (RPLC). Available from: https://rplcarchive.ca/wp-content/uploads/2019/03/Penner-Kevany-Longboat-2019-Indigenous-Food-Sovereignty-in-Canada-Policy-Brief.pdf.
5. Thiemann L, Roman-Alcalá A (2019) Fast food sovereignty: Contradiction in terms or logical next step? *J Agric Environ Ethics* 32: 813–834. https://doi.org/10.1007/s10806-019-09800-4
6. Nardone A, Ronchi B, Lacetera N, et al. (2010) Effects of climate changes on animal production and sustainability of livestock systems. *Livest Sci* 130: 57–69. https://doi.org/10.1016/j.livsci.2010.02.011
7. Rojas-Downing M, Nejadhashemi A, Harrigan T, et al. (2017) Climate change and livestock: Impacts, adaptation, and mitigation. *Clim Risk Manag* 16: 145–163. https://doi.org/10.1016/j.crm.2017.02.001
8. Blanke J (2020) Economic impact of COVID-19: Protecting Africa's food systems from farm to fork. Africa in focus public brief. Available from: https://www.brookings.edu/blog/africa-in-focus/2020/06/19/economic-impact-of-COVID-19-protecting-africas-food-systems-from-farm-to-fork/.
9. Oduniyi SO, Rubhara TT, Antwi MA (2020) Sustainability of livestock farming in South Africa. Outlook on production constraints, climate-related events, and upshot on adaptive capacity. *Sustainability* 12: 2582. https://doi.org/10.3390/su12072582
10. Department of Agriculture, Land Reform and Rural Development (DALRRD) (2020) Media statement: Minister Didiza announces the outcome of the COVID-19 agricultural disaster fund application process. Republic of South Africa. Available from: https://www.daff.gov.za/docs/media/Statement%20on%20the%20outcome%20of%20the%20agriculture%20distaster%20fund%20application%20process.pdf.
11. Popoola OO, Yusuf SFG (2021) South African government palliative funds for agriculture amid COVID-19: Challenges of implementation and suggestions for improvements. *SAJAE* 49: 16–30. http://doi.org/10.17159/2413-3221/2021/v49n3a12840
12. Maltitz LV, Bahta YT (2021) Empowerment of smallholder female livestock farmers and its potential impacts to their resilience to agricultural drought. *AIMS Agric Food* 6: 603–630. https://doi.org/10.3934/agrfood.2021036
13. Department of Agriculture Forestry and Fisheries (2019) Abstract of Agricultural Statistics; Department of Agriculture, Forestry and Fisheries: Pretoria, South Africa. Available from: http://www.dalrrd.gov.za/phocadownloadpap/Statistics_and_Economic_Analysis/Statistical_Information/Abstract%202019.pdf.
14. Marchant-Forde JN, Boyle LA (2020) COVID-19 effects on livestock production: A one welfare issue. *Front Vet Sci* 7: 585787. https://doi.org/10.3389/fvets.2020.585787
15. Oluwatayo IB (2019) Towards assuring food security in South Africa: Smallholder farmers as drivers. *AIMS Agric Food* 4: 485–500. https://doi.org/10.3934/agrfood.2019.2.485

16. Scanlan SJ (2003) Food security and comparative sociology. *Int J Soc* 33: 88–111. https://doi.org/10.1080/15579336.2003.11770272
17. Shahzad MA, Qing P, Rizwan M, et al. (2021) COVID-19 pandemic, determinants of food insecurity, and household mitigation measures: A case study of Punjab, Pakistan. *Healthcare* 9: 621. https://doi.org/10.3390/healthcare9060621
18. Shahzad MA, Razzaq A, Qing P, et al. (2022) Food availability and shopping channels during the disasters: Has the COVID-19 pandemic changed peoples' online food purchasing behavior? *Int J Dis Risk Reduct* 83: 103443. https://doi.org/10.1016/j.ijdrr.2022.103443
19. Hosu SY, Cishe EN, Luswazi PN (2019) Vulnerability to climate change in the Eastern Cape province of South Africa: What does the future hold for smallholder crop farmers? *Agrekon* 55: 133–167. https://doi.org/10.1080/03031853.2016.1157025
20. South African Government (2017) South Africa's Provinces. Available from: http://www.gov.za/about-sa/south-africas-provinces.
21. Statistics South Africa (Stats-SA) (2022) South Africa: General households survey 2021. Available from: https://www.datafirst.uct.ac.za/dataportal/index.php.
22. Aphiwe K (2017) Assessment of production practices of emerging cattle farmers in the selected districts of the Eastern Cape province, South Africa. Master thesis, Central University of Technology.
23. South Africa Travel Online (2023) Map of South Africa showing Eastern Cape Province. Available from: https://www.southafrica.to/provinces/provinces.php.
24. Ballard TJ, Kepple AW, Cafiero C (2013) The food insecurity experience scale: Development of a global standard for monitoring hunger worldwide. Available from: http://www.fao.org/fileadmin/templates/ess/voh/FIES_Technical_Paper_v1.1.pdf.
25. Cafiero C, Melgar-Quiñonez H, Ballard T, et al. (2014) Validity and reliability of food security measures. *Ann NY Acad Sci* 1331: 230–248. https://doi.org/10.1111/nyas.12594
26. Aboaba K, Fadiji D, Hussayn J (2020) Determinants of food security among rural households in Southwestern Nigeria: USDA food security questionnaire core module approach. *J Agribus Rural Dev* 2: 113–124. https://doi.org/10.17306/J.JARD.2020.01295
27. Kassie M, Stage J, Teklewold H, et al. (2015) Gendered Food Security in Rural Malawi: Why is women's food security lower? *Food Sec* 7: 1299–1320. https://doi.org/10.1007/s12571-015-0517-y
28. World Food Programme (WFP) Gender Office (2020) The power of gender equality for food security: Closing another gender data gap with a new quantitative measure. Available from: https://www.wfp.org/publications/power-gender-equality-food-security.
29. Nord M, Cafiero C, Viviani S (2016) Methods for estimating comparable prevalence rates of food insecurity experienced by adults in 147 countries and areas. *J Phys: Confer Ser* 772: 012060. https://doi.org/10.1088/1742-6596/772/1/012060
30. Papke LE, Wooldridge JM (1996) Econometric methods for fractional response variables with an application to 401(K) plan participation rates. *J Appl Economet* 11: 619–632. https://doi.org/10.1002/(SICI)1099-1255(199611)11:6<619::AID-JAE418>3.0.CO;2-1
31. Gallani S, Krishnan R, Wooldridge JM (2015) Applications of fractional response model to the study of bounded dependent variables in accounting research. Available from: https://hbswk.hbs.edu/item/applications-of-fractional-response-model-to-the-study-of-bounded-dependent-variables-in-accounting-research.

32. Oberhofer H, Pfaffermayr M (2012) Fractional response models-A replication exercise of Papke and Wooldridge (1996). *Contemp Econ* 6: 56–64. https://doi.org/10.5709/ce.1897-9254.50
33. Williams R (2019) Analyzing proportions: Fractional response and zero one inflated beta models. Available from: https://www3.nd.edu/~rwilliam/xsoc73994/FractionalResponseModels.pdf.
34. Maluleke R (2019) *Towards measuring the extent of food security in South Africa. An examination of hunger and food inadequacy. Report 03-00-14*, Statistics South Africa: Pretoria.
35. Mbewana V (2018) The determinants of food security status among indigent rural households in the Isikelo community of the Mbizana local municipality, Eastern Cape Province, Master thesis, University of Zululand.
36. Ngumbela X, Khalema E, Nzimakwe T (2020) Local worlds: Vulnerability and food insecurity in the Eastern Cape Province of South Africa. *Jàmbá-J Disaster Risk Stud* 12: a830. https://doi.org/10.4102/jamba.v12i1.830
37. Kahsay S, Mulugeta M (2014) Determinants of rural household food insecurity in Laelay Maichew Woreda Tigray, Ethiopia. *Afr J Agric Food Sec* 2: 106–112.
38. Masuku M, Selepede B, Mtyingizane S (2015) Factors contributing to household food insecurity in Mhlontlo area, Eastern Cape, South Africa. *Afr J Hospitality, Tourism Leisure* 4: 1–15.
39. Jebran K, Abdullah A, Iqbal A, et al. (2016) Effects of remittances on per-capita economic growth of Pakistan. *Pak Bus Rev* 18: 1–18.
40. World Health Organization (2001) Declaration of Helsinki. *Bull Word Health Org* 79: 373–374.

AIMS Press