HOUSEHOLDS FOOD CONSUMPTION BEHAVIOUR DURING COVID-19 PANDEMIC: EVIDENCE FROM RURAL HOUSEHOLDS IN SOUTH AFRICA

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Abstract: *The food consumption behaviour of households has been affected by the lockdown restrictions that were implemented to reduce the COVID-19 infection rate. This study was aimed at analysing the food consumption behaviour of rural households during the COVID-19 pandemic in South Africa. To achieve this, a simple random technique was used to collect data from 120 in Merry Pebble (MP) Stream Village. Thereafter, an Ordered Probit Model was used to examine the extent to which households have increased, decreased or maintained the same quantity of food consumed during COVID-19. The results indicated that 46.7% of the rural households had consumed less food during COVID-19 pandemic, 32.5% consumed about the same amount of food, and 20.8% consumed more food. The variables that contributed towards a decrease in food consumption are employment status, household size, loss of income, and social relief grants. On the contrary, bulk buying and food parcels had stabilised food consumption, while the number of employed people in a household and food bought from restaurants contributed towards an increase in food consumption during COVID-19 pandemic. With regard to consumption behaviour per food item, fresh produce, meat, snacks and fast food were consumed less during COVID-19, while there was a constant consumption in dairy products, and an increase in consumption of canned food, frozen food, prepared food, grains and water. The study recommends that the government should continue with the economic and social relief programmes that were created during COVID-19, as they play an important role in increasing and stabilising food consumption by rural households*

INTRODUCTION

During the early days of the COVID-19 pandemic in South Africa, lockdown was introduced as a strategy to reduce the infection rate (Kollamparambil and Oyenubi, 2021). Moreover, during Alert Levels 5 and 4 of the lockdown, trade between countries was restricted, borders were closed, and logistic restrictions were imposed, which resulted in a decrease in the supply of goods and services. This affected the purchasing behaviours of the consumers. For instance, consumers started panic buying (bulk buying), which led to purchasing limits being imposed and stock-outs occurring for many food items (Schneeweiss et al. 2020). As a result of bulk buying by those with high levels of affordability, shortages of prod-ucts in retail stores resulted, and demand started to increase to more than what suppliers could supply. Therefore, to balance the demand and the supply of the commodities, some retail food stores increased prices of certain food items, such as meat, dairy, and eggs (Staff Writer, 2021).

Because of COVID-19 lockdown restrictions, some businesses had to shut down temporarily, resulting in job losses and loss of profit. Consequently, most households experienced a decrease in income, which affected their budget, resulting in a decrease in the level of affordability of food products (Rakhmanov et al. 2020). Moreover, gross domestic product (GDP) declined by 2.0% in the first quarter of 2020 (Stats SA, 2020), as the production of some goods and services was not taking place. This decrease in the amount of goods and servic-

es produced contributed to a shortage of some food products. In view of this, the government introduced the R500 Billion Stimulus Package to address the economic and social welfare losses caused by lockdown. Parts of the package were allocated for social safety net programmes for poor households through a temporary increase in social grants and the introduction of a new grant called the COVID-19 Social Relief of Distress Grant (SRD R350 grant), together with the distribution of food parcels.

The food consumption patterns for most rural households could have changed as a result of this intervention and the economic consequences of lockdown, such as income and job losses, and increases in food prices. Hence, there is a need for this study to analyse the food consumption behaviour of rural households. In particular, as to whether there has been a constant state, increase, or decrease in food consumption during COVID-19 pandemic in South Africa. This is achieved through two study objectives, of which the first is to examine rural households' food consumption behaviour during COVID-19 pandemic. By so doing, this study contributes to literature by providing an insight into the extent to which rural households' food consumption was affected by the COVID-19 lockdown restrictions. The second objective is to determine the influence of several factors on rural households' food consumption behaviour during the COVID-19 pandemic. An identification of those factors would assist policymakers in creating new food policies aimed at improving access to food by rural households in South Africa.

The remainder of this paper is organised as follows. Section 2 presents a review of previous studies on households' food consumption in the COVID-19 era. Section 3 describes the research methods, including study area, sampling procedure and data collection methods. The analytical techniques for data analysis and the variables under study are also described in that section. Section 4 discusses both the descriptive and empirical findings. Section 5 presents the conclusion, including implications and recommendations, of this study.

LITERATURE REVIEW

The aim of the review is to underline the main findings deducted from previous empirical studies and, in the end, identify the gap in literature that the current study intends to fill. Special attention is given to the main findings regarding the factors reported to have influenced consumption behaviour during COVID-19.

Chenarides et al. (2021) investigated food shopping behaviours and consumption during the pandemic caused by COVID-19 in the United States of America (in two major metropolitan areas). An Ordered Probit Model was used to analyse data. The results obtained indicated that approximately 75% of the participants purchased the food they could get as a result of stock, and approximately 50% of participants purchased more food than under normal conditions. Moreover, consumers reported that they had purchased more groceries than under normality due to food service closures. The findings for food consumption behaviour showed that there was stable consumption of most food items. However, a larger per-

centage of the participants indicated that they had consumed more snacks since the inception of the pandemic, which is attributed to a sudden decline in consumption of fast food. Potential variables affecting consumption found by the study are socio-characteristics, food assistance and food shopping behaviours during COVID-19, and programmes for grocery pick-up and delivery, before and during COVID-19.

Hassen et al. (2020) have examined the effects of COVID-19 on consumers' awareness in Qatar, covering their attitudes and behaviours associated with food consumption in Qatar. Multiple Response Analysis was conducted to analyse the data. The results obtained indicated a surge in the consumption of local products due to food safety fears, a sharp increase in online grocery shopping, the nonexistence of stockpiling and panic buying of food, and an increase in cooking capabilities. Potential variables affecting food consumption in Qatar are the socio-characteristics of the participants and changes in behaviour during COVID-19 in Qatar with respect to changes in drinking or eating behaviour, changes in food-related behaviour, and behaviour regarding changes to food waste and stocking up of food.

Janssen et al. (2021) investigated changes in the consumers' food consumption behaviour of residents in Denmark, Germany and Slovenia. A Multinomial Regression Model was used to analyse the data. The results showed that food items that had experienced a higher rate of change were cake and biscuits, canned food and frozen food. Food items with a lower rate of change were dairy products, alcoholic drinks and bread. The potential variables, which affected food consumption, are food consumption frequencies, changes in shopping frequency, and socio-characteristics.

Laato et al. (2020) investigated the changes at individual consumer level and the influence of different factors related to the COVID-19 pandemic on changes in food consumption in Finland. The Stimulus-Organism-Response (S-O-R) framework was used for the empirical analysis. As with the study by Janssen et al. (2021), the results showed that food items that had experienced a higher rate of change were cake and biscuits, canned food and frozen food, while dairy products, alcoholic drinks and bread were food items with lower rates of change. In addition, many people experienced cyberchondria and an increase in information overload through the excessive exposure to online information sources. The results further indicated that cyberchondria significantly influenced unusual food purchasing behaviour and voluntary self-isolation. The potential variables that affected food consumption were cyberchondria, intention to self-isolate, online information, information overload, severity intention to make unusual purchases, source perceived, self-isolation, purchase self-efficacy and self-efficacy (Laato et al. 2020).

Fanelli (2021) investigated changes in food consumption and food-related behaviour of consumers in the Campobasso and Isernia provinces of Italy during the initial phase of lockdown. A Kapetanios and Shin Unit Root (KSUR) test was used to analyse the data. The results suggested that the effects of COVID-19 on consumer behaviour could be segregated into eating habits, changes in food shopping behaviour, and food-related behaviour. Potential variables that influenced changes

in food consumption were socio-characteristics, shopping for food, food as an antidote to anxiety, and changes in the shopping basket. Other variables were changes in diet, adherence to a Mediterranean diet, changes in eating habits and activities, food safety and difficulty encountered in finding certain food products.

The main findings from the previous studies can be summarised as follows. Previous studies indicated that there have been changes in behavioural consumption of food during COVID-19. Moreover, they discovered an overall decrease in the consumption of certain food items (i.e. fresh foods, bread, fast foods, dairy products and alcoholic drinks), but a shift towards consumption of food items with a longer shelf life (i.e. canned food, frozen food and snacks). In addition, consumers had stockpiled food in order to avoid trips to the food stores, as a mechanism to safeguard against COVID-19. Previous studies further indicated that the effects of COVID-19 on consumer behaviour could be segregated into eating habits, changes in food shopping behaviour, and food-related behaviour.

RESEARCH METHODOLOGY

Study area

This study focused on the food consumption behaviour of rural households in South Africa; hence, data were collected from MP Stream Village. MP Stream is one of the villages in the Bushbuckridge Local Municipality, which is located in the Bohlabela District in the Mpumalanga Province. According to Agincourt (2018), MP Stream Village has a population of 6771, with 1196 households. According to Bushbuckridge Local Municipality's IDP (2020), there was a high unemployment rate in MP Stream Village. Because of COVID-19, most consumers in the villages, like MP Stream Village, lost their jobs, which could have affected their level of food affordability due to a reduction in household incomes. Hence, MP Stream Village was used as the case study.

Sampling

From the total MP Stream population of 6771, comprising 1196 households, a sample size of 120 households (10.03%) were drawn by using a simple random sampling technique. Simple random sampling was adopted as it allows or gives each household an equal probability of being chosen in the sample (Mohsin, 2016). In applying this technique, a list of MP Stream Village households was obtained from the traditional leaders, thereafter a simple random selection was used to select the sample of 120 households that were interviewed in the study.

Data collection

Primary data was collected through using a face-to-face questionnaire in 2021, which constituted the key instrument used to collect data from the respondents. The questionnaire was composed of open-ended and close-ended questions. The questionnaire had two separate sections. The first section pro-

vided information about the socioeconomic characteristics of the respondents, such as age, household size, marital status, employment status, and loss of income. Other COVID-19 related factors were also embedded in the first section, such as food parcels received, social relief grants, information sources about COVID-19, consumption of food from restaurants during COVID-19, and bulk buying. The second section included questions on changes in households' food consumption behaviour during COVID-19 pandemic.

The questionnaires were pre-tested on a small sample of rural households before the full-scale survey was conducted, in line with the guidelines published by GAO (2019), to enhance the validity and reliability of the data. The pre-tested questionnaires were excluded from the sample data. In meeting the necessary ethical standards, the respondents' consent was sought and the purpose of the research was explained before interviews were conducted. Further to this, the respondents were given assurance that the information collected will be treated with confidentiality (with no mentions of names), and were informed that participation in the survey was voluntary.

Descriptive analysis

Descriptive analyses were conducted to address the first objective of the study, which is to examine rural households' food consumption behaviour during COVID-19 pandemic. Food consumption behaviour is defined, in this study, as changes in food consumption patterns (frequencies) of a household, in terms of a constant state, decrease or an increase in food consumption. Changes in food consumption were measured, in line with Chenarides et al. (2021), by asking respondents, "How has your consumption been affected during COVID-19 pandemic, with regard to a decrease, increase, or constant consumption?" Consequently, several food categories were used to examine changes in the rural households' food consumption. These food categories are, in line with Chenarides et al. (2021), canned food, fresh produce, frozen food, dairy, prepared food, meat, grains, snacks, water and fast food. Ultimately, the descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of these food categories by rural households.

Empirical analysis

Considering the discrete nature and ordinal ranking of the "food consumption behaviour" variable, an Ordered Probit Model was used in the empirical analysis. The unobserved preference obtained by households to maintain their consumption frequency during COVID-19 is as follows (Chenarides et al. 2021):

$$Y_{it} = \quad \beta x_i + \varepsilon_i \qquad (1)$$

x_i represents predictor variables, defined as variables that explain food consumption behaviour, including socio-characteristics. β represents x_i coefficients, and ε_i is an error term, which follows a standard normal distribution. Factor yi is the observed ordinal variable, representing the food consumption frequency of households, which is described as follows (Chenarides et al. 2021):

$$Y_{it} = \beta x_i + \varepsilon_i \tag{2}$$

where j = 0, …, M is the number of possible y outcomes where the highest category is M, and u_j's are unknown cut-off values. In this study, M is equal to three. By assuming the error term ε_i to follow a standard normal distribution, probabilities for $y\_(i)$ are (Chenarides et al. 2021):

$$Pr(y_i = 0) = \int_{-\infty}^{-\beta x_i} \phi(\varepsilon_i) d\varepsilon_i = \Phi(-\beta x_i), \tag{3}$$

$$Pr(y_i = 1) = \int_{-\beta x_i}^{u_1 - \beta x_i} \phi(\varepsilon_i) d\varepsilon_i = \Phi(u_1 - \beta x_i) - \Phi(-\beta x_i),$$

$$Pr(y_i = M - 1) = \int_{u_{M-2} - \beta x_i}^{u_{M-1} - \beta x_i} \phi(\varepsilon_i) d\varepsilon_i = \Phi(u_{M-1} - \beta x_i) - \Phi(u_{M-2} - \beta x_i),$$

$$Pr(y_i = M) = \int_{u_{M-1} - \beta x_i}^{u_M - \beta x_i} \phi(\varepsilon_i) d\varepsilon_i = \Phi(u_M - \beta x_i) - \Phi(u_{M-1} - \beta x_i) = 1 - \Phi(u_{M-1} - \beta x_i)$$

where ϕ represents the standard normal probability density, while Φ represents the cumulative distribution functions (Chenarides et al. 2021; Haobijam et al. 2021).

The base category or reference category is identified as a category of comparison for the other categories; therefore, the base category in the study was increase in food consumption, where it was used as a point of reference for other categories (i.e. decrease in food consumption and constant food consumption).

The Ordered Probit Model was further used to compute the marginal effects and predicted probabilities for each food consumption category. In line with Cranfield and Magnusson (2003), when computed at the averages of the data, the predicted probabilities show the probability that an average household's food consumption would fall within each of the food consumption categories. The parameter estimates (coefficients) are used to compute the marginal effects of predictor variables on the predicted probabilities. Marginal effects denote how a change in one of the predictor variables influences the predicted probability that a household's food consumption behaviour falls within each category of consumption frequencies. The change in probabilities for the consumption frequencies must be equal to zero, since the sum of probabilities for the consumption categories must equal one (Cranfield and Magnusson, 2003). The marginal effects for the discrete (categorical) variables and continuous variables are calculated differently (Williams, 2012). The equation for the marginal effects for the binary variables is as follows:

$$\frac{\partial Pr(INC = j-1)}{\partial x k} = [\phi(\gamma j - 1 - \boldsymbol{X\beta}) - \phi(\gamma - j - \boldsymbol{X\beta})]\beta k, \tag{4}$$

where ϕ(.) represents the normal probability distribution function. Marginal effects for the binary predictor variables are discretely estimated – they measure the difference in predicted probabilities, as the binary variable is set equal to zero and one (Cranfield and Magnusson, 2003). Marginal effects for continuous variables measure the rate of change in the predicted probabilities due to a 1-unit change in the predictor variable. The equation for the marginal effects for the continuous variables is as follows:

$$\frac{\triangle Pr(INC = j-1)}{\triangle x k} = \theta(INC = j - 1 | x k = 1) - \theta((INC = j - 1 | x k = 0) \tag{5}$$

Several predictor variables (factors), which are thought to influence household food consumption behaviour, can be augmented in the empirical model. Thus, the specific Ordered Probit Model used in this study to determine the relationship between food consumption behaviour and several factors is described as follows:

$$\tag{6}$$

$Y_i = \beta_0 + \beta_1 GEND + \beta_2 AGE + \beta_3 HS + \beta_4 EPH + \beta_5 MS + \beta_6 EDL + \beta_7 EPS + \beta_8 TE + \beta_9 TS + \beta_{10} GR + \beta_{11} FPA + \beta_{12} SRG + \beta_{13} MIHH + \beta_{14} ILP + \beta_{15} SCP + \beta_{16} CR + \beta_{17} PFRS + \beta_{18} HPS + \beta_{19} BB + U$

where: Yi = food consumption behaviour; β0 = constant; β0 – β19 = parameters of estimates; and GEND–BB = abbreviations for several factors that might affect food consumption behaviour.

RESULTS AND DISCUSSION

Descriptive results

This section presents the descriptive results for the dependent variable and predictor variables. The dependent variable is explained in respect of changes in food consumption in terms of whether there was a decreased, increased, or constant consumption of food by rural households. The predictor variables are explained in terms of factors considered to influence the food consumption behaviour of households. The descriptive results for the dependent variable and predictor variables are presented in Table 1.

Table 1: Descriptive statistics

CATEGORICAL VARIABLES			
Variable	**Category**	**Frequency**	**Percentage**
Dependent variable			
Food consumption frequency	Consumed less	27	0.252
	Consumed about the same	34	0.263
Predictor variables			
Gender	Male	39	32.5%
	Female	81	67.5%
Age	Less than 18	2	1.7%
	18-35	33	27.5%
	36-50	47	39.2%
	Above 50	38	31.7%
Education	No formal education	12	10%
	Primary education	13	10.8%
	Secondary education	64	53.4%
	Tertiary education	31	25.8%
Marital status	Single	50	41.7%
	Married	35	29.2%
	Divorced	13	10.8%
	Widow	22	18.3%
Employment status	Not employed	73	60.8%
	Employed	47	39.2%
Type of employment	Full time	28	23.3%
	Part-time	11	9.2%
	Contract	8	6.7%
	Unemployed	73	60.8%

Type of sector	Formal	30	25%
	Informal	17	14.2%
	Not employed	73	60.8%
Grants	Old age	15	12.5%
	Child support	26	21.7%
	Care dependency	2	1.7%
	Grant in aid	0	0%
	War veteran	5	4.2%
	Foster child	1	0.8%
	Disability	5	4.2%
	Not receiving grant	66	55%
Monthly income	Less than R5 000	62	51.7%
	R5 000-R9 999	29	24.2%
	R10 000-R14 999	8	6.7%
	R15 000-R19 999	12	10%
	Above R20 000	9	7.5%
Income loss due to pandemic	Yes	54	45%
	No	66	55%
Information sources about COVID-19	Health institution	14	11.7%
	Social media	30	25%
	Family and friends	21	17.5%
	Television	37	30.8%
	Radio	18	15%
Social relief grant	Yes	52	43.3%
	No	68	56.7%
Food parcels	Yes	43	35.8%
	No	77	64.2%
Consumption of restaurant food	Yes	49	40.8%
	No	71	59.2%
Preferred food retail store	Shoprite	37	30.8%
	Boxer	35	29.2%
	Pick n Pay	33	27.5%
	Checkers	5	4.2%
	Woolworths	10	8.3%
	Other	0	0%
Grocery purchasing frequency	Daily	5	4.2%
	Weekly	24	20%
	Monthly	85	70.8%
	Whenever I need food	6	5%
	Other	0	0%
Bulk buying	Yes	57	47.5%
	No	63	52.5%

CONTINUOUS VARIABLES				
Variable	**Minimum**	**Maximum**	**Mean**	**St. Deviation**
Household size	1	11	5	2.480
Number of employed people	0	5	1	0.860

Source: Research Data (2021)

The results for food consumption behaviour (i.e. dependent variable) revealed that about 46.7% of the respondents from the sample size consumed less food during COVID-19, 32.5% consumed about the same amount, and 20.8% of the respondents consumed more food during the COVID-19 pandemic. These signify that majority of the households consumed less food during COVID-19, while fewer households consumed more food during COVID-19. The lower consumption of food is attributed to unemployment, as the descriptive results for employment status revealed that majority of the respondents were unemployed (60.8%).

The descriptive results for the predictor variables are as follows. With regard to gender, 32.5% of the respondents were males and 67.5% were females, indicating that there were more female-headed households than male-headed households. Regarding the age of the household heads, majority of the respondents were within the age category of 36 to 50 (39.2%), while fewer respondents were younger than 18 years (1.7%). Concerning the marital status, most respondents were single (41.7%), while the lowest numbers of respondents were divorced (18.3%). In terms of the level of education, most of the respondents had received secondary education (53.5%), while fewest of the respondents had no formal education (10%).

Regarding the employment status, 60.8% of the respondents were not employed, while 39.2% were employed. These statistic are in line with the high unemployment rate within the country. In terms of the nature of employment, fewer respondents were employed on a contract basis (9.2%), majority were unemployed (60.8%), while others were employed on a full time (23.3%) and part time basis (9.2%). In terms of the type of employment sector, 25% of the respondents were employed in the formal sector, 14.2% were employed in an informal sector, while 60.8% were not employed. For the type of employment sector, the results showed that while most respondents were not employed (60.8%), a majority of those who were employed, were employed in the manufacturing sector (6.7%), with fewer being employed in the finance sector (0.8%).

With regard to receiving a grant, most respondents did not receive social grants (55%), while fewer respondents received social grants (45%). In terms of the nature of the grant, majority of the respondents received child support grants (21.7%), while fewer respondents received the foster child grant (0.8%). Concerning monthly income, most household heads received a monthly income of less than R5 000 (51.7%), while fewer received monthly incomes between R10 000 and R14 999 (10%). With regard to loss of income, the majority of the respondents did not lose income during COVID-19 (55%), while fewer lost income during COVID-19 pandemic (45%). These results are attributed to the fact that the majority of the respondents (60.8%) were unemployed; hence, most respondents did not lose income during the COVID-19 pandemic.

In terms of information sources, most respondents obtained information about COVID-19 from television (30.8%), while fewer respondents received information from health institutions (11.7%). Regarding the social relief grant, 43.3% of the respondents received the Social Relief of Distress Grant (SRD, R350), while the other 56.7% did not. These results signify that most of the respondents did not receive the Social Relief of Distress Grant, as some (those who had lost employment during COVID-19) were receiving income relief through the Unemployment Insurance Fund (UIF).

Concerning the food parcels, 35.8% of the respondents received the food parcels, while 64.2% did not receive food parcels. This indicates that the majority of the respondents did not receive food parcels, which is attributed to the alleged incidents of nepotism in the allocation of food parcels and looting of food parcels (Mahlangu, 2020; Staff Writer, 2020; Tau et al. 2020). With regard to the consumption of restaurant food,

40.8% of the respondents consumed food from restaurants, while 59.2% did not consume food from restaurants during the COVID-19 pandemic. This finding is attributed to the closure of restaurants during Alert Levels 5 and 4, and restrictions of trading hours during the COVID-19 due to the curfew.

Concerning their preferred retail stores, the majority of the respondents preferred purchasing from Shoprite (30.8%), while fewer respondents preferred purchasing from Checkers (4.2%). This finding is attributable to the fact that Shoprite is more accessible to rural households, as it has more stores around the country.

For grocery purchasing frequency, most respondents purchased their groceries monthly (70.8%), while fewer respondents purchased groceries daily (4.2%). This is because most people receive their income monthly; hence, most households purchased grocery monthly. With regard to bulk buying, most respondents did not participate in bulk buying (52.5%), which is attributed to lacking or limited income, as most respondents were unemployed.

The descriptive statistics results for the continuous variables are included in Table 1, alongside the statistics for the dependent variable and predictor variables (i.e. categorical variables). The statistics show that the average household size was 5, with a minimum of 1 person in a household, and a maximum of 11 people. The number of employed people in a household ranged from a minimum of 0, with an average of 1, to a maximum of 5.

Households' food consumption behaviour per food item

Several food categories were used to examine changes in the food consumption of rural households. These food categories were fresh produce, dairy, frozen food, canned food, prepared food, meat, grains, snacks, water and fast food. The descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of these food categories by rural households. The results for food consumption per food item are presented in Table 2 below.

Table 2: Food consumption per food item

Variable	Category	Frequency	Percentage
Fresh produce	Consumed less	50	41.7%
	Consumed about the same	47	39.2%
	Consumed more	23	19.1%
Dairy	Consumed less	42	35%
	Consumed about the same	46	38.3%
	Consumed more	32	26.7%
Frozen food	Consumed less	33	27.5%
	Consumed about the same	38	31.7%
	Consumed more	49	40.8%
Canned food	Consumed less	35	29.2%
	Consumed about the same	41	34.1%
	Consumed more	44	36.7%
Prepared food	Consumed less	28	23.3%
	Consumed about the same	36	30%
	Consumed more	56	46.7%
Meat	Consumed less	44	36.7%
	Consumed about the same	42	35%
	Consumed more	34	28.3%
Grains	Consumed less	41	34.3%
	Consumed about the same	35	29%
	Consumed more	44	36.7%
Snacks	Consumed less	53	44.2%
	Consumed about the same	43	35.8%
	Consumed more	24	20%
Water	Consumed less	36	30%
	Consumed about the same	41	34.2%
	Consumed more	43	35.8%
Fast food	Consumed less	43	35.8%
	Consumed about the same	41	34.2%
	Consumed more	36	30%

Source: Research Data (2021)

The results for consumption of fresh produce are that 41.7% of the respondents indicated that they had consumed less fresh produce, with 39.2% indicating that they had consumed about the same, and 9.1% indicated that they had consumed more fresh produce during the COVID-19 pandemic. The lower consumption of fresh produce by most households is attributed to the fact that the informal fresh produce traders (street vendors) were not allowed to operate during Alert Level 5, while only those with trading licences or permits were allowed to operate during Alert Level 4. These results are in line with those of previous studies, which found an overall reduction in consumption of fresh produce in Italy (Fanelli, 2021), Denmark, Germany and Slovenia (Janssen et al. 2021). However, these results are in contradiction to those of Hassen et al. (2020) and Chenarides et al. (2021), who ascertained an increase in the consumption of fresh produce products in Qatar and the United States, respectively, during the COVID-19 pandemic.

With regard to dairy products consumption, 35% of the respondents indicated that they had consumed less dairy products, with 38.8% indicating that they had consumed about the same and 26.7% indicating that they had consumed more dairy products during the COVID-19 pandemic. The lower consumption of dairy products is attributed to the surge in dairy prices during the COVID-19 pandemic in South Africa (Stats SA, 2021). However, these results are in contradiction to those of previous studies that found that there was an increase in the consumption of dairy products in Italy (Fanelli, 2021), Qatar (Hassen et al. 2020), and the United States (Chenarides et al. 2021) during the COVID-19 pandemic.

In terms of frozen food, 40.8% indicated that they had consumed more frozen food, 31.7% indicated that they consumed about the same amounts, while 27.5% of the respondents indicated that they had consumed less frozen food during the COVID-19 pandemic. The higher consumption of frozen foods is alluded to households' preference for food items that had a long shelf life to minimise travelling to buy food in order to protect themselves from contracting COVID-19. These results are in line with those of previous studies, which found that there was an increase in the consumption of frozen foods in Italy (Fanelli, 2021), the United States (Chenarides et al.

2021), and Denmark, Germany and Slovenia (Janssen et al. 2021) during the COVID-19 pandemic. However, the results are in contradiction to those of Hassen et al. (2020), as they discovered a constant consumption in frozen food in Qatar during the COVID-19 pandemic.

Concerning canned foods, 29.2% of the respondents indicated that they had consumed less canned food, 34.1% indicated that they had consumed about the same amounts, and 36.7% indicated that they had consumed more canned food during COVID-19. This suggests that there was a shift away from food with a shorter shelf life, as most households consumed less fresh produce, to foods with a longer shelf life. These results are in line with those of previous studies, which found an overall reduction in the consumption of fresh produce in Italy (Fanelli, 2021), and Denmark, Germany and Slovenia (Janssen et al. 2021). However, these results are in contradiction to those of Hassen et al. (2020) and Chenarides et al. (2021), who found an increase in the consumption of fresh produce products in Qatar and the United States, respectively, during the COVID-19 pandemic.

In the case of prepared food, 46.7% of the respondents indicated that they had consumed more amounts of prepared food, 30% indicated that they consumed about the same amounts, while 23.3% of the respondents indicated that they had consumed lower amounts of prepared food during COVID-19. This means that most households consumed more prepared food, while fewer households consumed less prepared food during COVID-19. This shows that there was a shift away from restaurant food to home-prepared food due to lockdown restrictions, which required closure of restaurants (Alert Levels 5 and 4) and restricted the movement of consumers and the trading hours of restaurants. The results are in line with the results of previous studies, which found that there was an overall increase in the consumption of home-prepared food during the COVID-19 pandemic in Italy (Fanelli 2021), Qatar (Hassen et al. 2020), and Denmark, Germany and Slovenia (Janssen et al. 2021). However, the results are in contradiction to those of Chenarides et al. (2021), as they found that there was a lower consumption of prepared food in the United States during COVID-19.

With regard to meat consumption, 36.7% of the respondents indicated that they had consumed less meat, 35% indicated that they had consumed about the same amounts, and 28.3% indicated that they had consumed more meat during COVID-19. This means that the majority of the households consumed less meat, while fewer households consumed more meat during COVID-19. This is a result of the increase in meat prices during COVID-19 in South Africa (Fin24 2021). The results are in line with those of a study by Janssen et al. (2021), which found that there was a decrease in the consumption of meat in Denmark, Germany and Slovenia during COVID-19. However, the results are contrary to those of Chenarides et al. (2021), as they discovered that there was an increase in the consumption of meat in the United States during COVID-19.

Concerning grains, 34.3% of the respondents indicated that they had consumed lower amounts of grains, 29% indicated that they had consumed about the same amounts, and 36.7%

indicated that they had consumed more amounts of grains during the COVID-19 pandemic. The results signify that the majority of the households consumed more amounts of grains during COVID-19, whereas fewer households consumed lower amounts of grains during COVID-19. This shows that there was a shift away from dietary foods (fresh produce), since most respondents consumed less fresh produce (39.2%), towards the consumption of staple foods. This shift is attributed to the fact that grains are more affordable and have a longer shelf life. The results are in line with those of previous studies (Chenarides et al. 2021; Janssen et al. 2021), which found that there was a greater consumption of grains in the United States, and in Denmark, Germany and Slovenia during COVID-19. However, the results are in contradiction to those of Hassen et al. (2020), who found that there was a lower consumption of grains in Qatar during COVID-19.

In the case of snacks, 44.2% of the respondents indicated that they had consumed fewer snacks, followed by respondents who had consumed about the same amount of snacks, at 35.8%, while 20% indicated that they had consumed more snacks during the COVID-19 pandemic. This means that most households consumed fewer amounts of snacks, while fewer households consumed more snacks during COVID-19. This was attributable to the restrictions that were imposed, since retail stores were not allowed to sell snacks during Alert Level 5 of the lockdown. The results are in contradiction to those of previous studies, which found that there was a general increase in snack consumption in the United States (Chenarides et al. 2021), Italy (Fanelli, 2021), Qatar (Hassen et al. 2020), and Denmark, Germany and Slovenia (Janssen et al. 2021) during COVID-19.

With regard to water, 30% of the respondents indicated that they had consumed lower amounts of water, 34.2% indicated that they has consumed about the same amounts, and 35.8% indicated that they had consumed more water during the COVID-19 pandemic. This shows that most households consumed more water, while fewer households consumed lower amounts of water. These results are contrary to those of previous studies by Hassen et al. (2020), who discovered that there was constant consumption of water in Qatar, and those of Chenarides et al. (2021), who found that there was less consumption of water in the United States during COVID-19.

Concerning fast food, 35.8% of the respondents indicated that they had consumed less fast food from restaurants, 34.2% indicated that they had consumed about the same amounts, and 30% indicated that they had consumed more fast food during the COVID-19 pandemic. The lower consumption of fast food is attributed to the closure of restaurants during Alert Levels 5 and 4, and to the restrictions of trading hours during COVID-19 because of the curfew. This shows that there was a shift away from the consumption of fast food towards the consumption of food prepared at home, foods with a long shelf life and grains. This is because the study found that most households had consumed more amounts of prepared food (46.7%) and foods with a long shelf life (canned food [36.7%]) and grains [36.7%]) during COVID-19. The results are in line with those of Chenarides et al. (2021) who discovered a decrease in the consumption of fast food in the United

States. However, the results are contrary to the results of other studies that discovered an increase in the consumption of fast food in Qatar (Hassen et al. 2020), and in Denmark, Germany and Slovenia (Janssen et al. 2021) during COVID-19.

Ordered Probit Model results

An Ordered Probit Model was used to determine the influence of several factors on the food consumption behaviour of rural households during the COVID-19 pandemic. The findings indicating the estimated coefficients, t-statistics, standard errors and levels of significance are shown in Table 3 below.

Table 3: Ordered Probit Model results

Variables	B coefficients	Standard error	T-statistics	Significance
Gender (GEND)	0.466	0.028	2.034	0.154
Age (AGE)	0.314	0.072	4.361	0.000***
Household size (HS)	-0.522	0.295	1.769	0.076*
Number of employed people in the household (EPH)	0.647	0.205	3.156	0.006***
Marital status (MS)	0.520	0.261	1.992	0.078*
Education (EDL)	0.721	0.494	0.525	0.469
Employment status of the household head (EPS)	0.534	0.286	1.867	0.083*
Type of employment (TE)	-1.905	0.418	2.193	0.139
Type of sector (TS)	0.063	0.205	0.875	0.350
Type of grant (GR)	-5.835	0.589	1.725	0.110
Food parcels or assistance (FPA)	0.419	0.108	3.879	0.003***
Social relief grant (SRG)	-0.414	0.237	1.746	0.081*
Income of the household head (MIHH)	-0.394	0.340	0.038	0.846
Loss of income (ILP)	-1.426	0.656	2.173	0.005***
Information sources about the COVID-19 (SCP)	0.269	0.114	2.359	0.004***
Food from restaurants (CR)	0.411	0.095	4.2810	0.000**
Preferred retail store (PFRS)	-0.547	0.638	0.735	0.391
Purchasing frequency (HPS)	-0.595	0.783	0.578	0.447
Bulk buying (BB)	0.275	0.073	3.666	0.000***
Model summary				
(-2) Log-likelihood		202.740		
Pseudo R-Square				
Cox and Snell R-Square		0.606		
Nagelkerke R-Square		0.640		

Source: Research Data (2021);
Note: *p < 0.1 **p < 0.05. ***p < 0.01

The analysis was undertaken by using the Statistical Package for the Social Sciences (SPSS). The (-2) Log-likelihood of the estimated model is 202.740, which implies that the model can be relied upon to predict the food consumption behaviour of households. A Nagelkerke pseudo-R2 of 0.640 was obtained, which signifies that the predictor variables account for approximately 64% of the variation in food consumption behaviour.

The Ordered Probit model was also used to derive the predicted probabilities and marginal effects for the three food consumption frequency categories, evaluated at the average of the data. The analyses were undertaken using STATA. The results for the predicted probabilities, as well as the marginal effects, are presented in Table 4.

Table 4: Ordered Probit Model (predicted probabilities and marginal effects)

Food consumption categories	FCF=0	FCF=1	FCF=2
Predicted probabilities	0.444	0.316	0.240
Variables	**Marginal effects**		
GEND	-0.011	-0.016	0.027
AGE	-0.041	0.020	0.021
HS	0.006	0.007	-0.013
EPH	-0.027	0.016	0.011
MS	-0.088	0.046	0.042
EDL	-0.043	0.006	0.037
EPS	-0.0013	0.009	0.004
TE	0.082	-0.044	-0.038
TS	-0.001	-0.002	0.003
GR	0.029	0.043	-0.072
FPA	-0.076	0.042	0.030
SRG	0.047	0.025	-0.072
MIHH	0.064	-0.009	-0.055
ILP	0.007	-0.0034	-0.0036
SCP	-0.091	0.047	0.044
CR	-0.054	0.032	0.022
PFRS	-0.018	0.008	0.010
HPS	-0.103	-0.137	0.240
BB	-0.087	0.046	0.041

Source: Research data (2021)

As per default, the values for the marginal effects for the three consumption frequency categories are equal to zero, while the values for the predicted probabilities for equal to one. The results for the estimated coefficients (Table 3) and marginal effects (Table 4) are discussed concurrently though the interpretation of the estimated effects and marginal effects differs. From the nineteen predictor variables that were included in the empirical analysis, eleven variables were significant, as presented in Table 3. Consequently, the discussion of the results for the coefficients and marginal effects are limited to the significant variables.

Age (AGE)

Age (AGE) Variable is significant at 1%, and has a positive influence on the food consumption behaviour of rural households. The marginal effects for the AGE Variable are negative for the first category of food consumption frequency ("less consumption"), but positive for the rest of the consumption categories ("constant consumption" and "more consumption"). This signifies that the older the head of a household is, the lower the probability of that household consuming less amount of food is, and the higher the probability of consuming stable or more

amounts of food. The implication is that households headed by older consumers are more likely to consume stable amounts or more food, while those headed by younger people are more likely to consume lower amounts of food.

Household Size (HS)

Household Size (HS) Variable is significant at 10%, and has a negative influence on food consumption behaviour of rural households. The marginal effects for HS are positive marginal effects for the first two categories of consumption, but a negative effect for the third category. This suggests that the larger the household is, the higher the probability is of consuming lower or stable amounts of food, compared with smaller households. In particular, larger households are more likely to consume lower or stable amounts of food, while smaller households are more likely to consume more food. This is attributable to the increase in food prices and the high unemployment rate experienced during the COVID-19 pandemic, since most respondents with larger household sizes were more likely to have been unemployed.

Number of employed people in the household (EPH)

The number of employed people in the household (EPH) Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects for the EPH Variable are negative for the first category of food consumption frequency and positive for the second and third categories. This indicates that the higher the number of employed people there are in a household, the higher the probability is of them consuming stable or greater amounts of food. On the contrary, the lower the number of employed people there are in a household, the higher the probability is of them consuming lower amounts of food. In other words, households with more numbers of employed people are more likely to consume stable or greater amounts of food, relative to those with lower numbers of employed people.

Marital status (MS)

The Marital Status (MS) Variable is significant at 10%, and has a positive influence on food consumption behaviour of households. The marginal effects for MS are negative for the first category of food consumption category and positive effects for the remaining categories. This means that being in a household headed by married consumers decreases the probability of consuming less food, and increases the probability of consuming stable or more amounts of food. In other words, households with married household heads were more likely to consume stable or greater amounts of food during the COVID-19 pandemic, while those with another marital status (i.e. single, divorced or widowed) were more likely to consume lower amounts of food.

Employment Status (EPS)

The Employment Status of the Household Head (EPS) Variable is found to be significant at 10%, and it was found to have a negative influence on food consumption behaviour.

The EPS has negative marginal effects for the first category of food consumption frequency, but positive for the other two categories. This signifies that being employed reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. In other words, households with employed heads of the household are more likely to consume stable or greater amounts of food, while those with unemployed heads of the household are more likely to consume lower amounts of food. However, these results are not as was expected, as employment is known to influence food consumption positively. This result is attributable to the fact that some of the employed consumers had experienced losses of income (45%) during the COVID-19 pandemic due to the temporary shutdown of operations in the nonessential sectors.

Food Parcels (FPA)

The Food Parcels (FPA) Variable has a positive influence on food consumption behaviour, as it is significant at 1%. The FPA Variable has negative marginal effects for the first category of food consumption frequency and positive effects for the second and third categories. This signifies that receiving food parcels reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. The implication is that households that receive food parcels are more likely to consume stable or greater amounts of food. On the contrary, those who do not receive food parcels are more likely to consume lower amounts of food.

Social Relief of Distress Grant (SRG)

Social Relief of Distress Grant (SRG) Variable is significant at 10%, and has a negative influence on food consumption behaviour. The marginal effects for the SRG Variable are positive for the first and second categories of food consumption frequencies and negative for the third category. This signifies that receiving the social relief of distress grant increases the probability of consuming lower or stable amounts of food, and reduces the probability of consuming greater amounts of food. In other words, households that received the social relief of distress grant were more likely to consume lower or stable amounts of food. On the contrary, those who did not receive the social relief of distress grant were more likely to consume greater amounts of food. The fact that the SRG increases the probability of stable amounts of food being consumed by the grant recipients implies that the social relief of distress grant plays an important role in stabilising food consumption by rural households.

Loss of Income (ILP)

The Loss of Income (ILP) Variable is significant at 1%, and has a negative influence on food consumption behaviour. The marginal effects for the ILP Variable are positive for the first category of food consumption frequencies, but negative for the remaining two categories. This indicates that losing income increases the probability of consuming lower amounts

of food, and reduces the probability of consuming stable or greater amounts of food. In other words, households whose heads lost income were more likely to consume less food, while those whose heads did not lose income were more likely to consume stable or greater amounts of food.

Information Sources about COVID-19 (SCP)

The information sources about COVID-19 (SCP) are significant, at 1%, and have a positive influence on food consumption behaviour. The variable SCP has negative marginal effects for the first category of food consumption frequency, but positive effects for the second and third categories. This signifies that receiving information about COVID-19 through television increases the probability of consuming stable or greater amount of food and decreases the probability of consuming lower amounts of food. In other words, households that received information about COVID-19 through television were more likely to consume stable or greater amounts of food. On the contrary, households that received information about COVID-19 through other sources (health institutions, social media, family and friends and radio) were more likely to have consumed lower amounts of food.

Food from Restaurants (CR)

The Food from Restaurants (CR) Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects of the CR Variable are negative for the first category of food consumption frequency, but positive for the remaining categories. This shows that purchasing food from restaurants reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. Thus, households that purchased food from restaurants were more likely to have consumed stable or greater amounts of food, relative to those that did not purchase food from restaurants.

Bulk Buying (BB)

The Bulk Buying Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects for the BB Variable are negative for the first category of food consumption frequency and positive effects for the second and third categories. This denotes that purchasing food in bulk reduces the probability of consuming lower amounts of food and increases the probability of consuming stable or greater amounts of food. Thus, households that engaged in bulk buying were more likely to have consumed stable or greater amounts of food, compared with those that did not engage in bulk buying.

CONCLUSION

Summary, implications and recommendations

The lockdown measures that were imposed to reduce the rate of COVID-19 infections in South Africa resulted in decreases in the supply of goods and services and income, as well as job losses and increases in food prices, all of which affected consumers' purchasing behaviours. Against this backdrop, this study aimed at analysing the food consumption behaviour of rural households. This was achieved through pursuing two objectives, the first of which was to examine the food consumption behaviour of rural households during the COVID-19 pandemic. To achieve this objective, descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of various food categories by rural households. The second objective was to determine the influence of several factors on the food consumption behaviour of rural households during the COVID-19 pandemic. An Ordered Probit Model was used to achieve this objective.

Overall, regardless of food items, there was a shift away from the consumption of certain food items towards the consumption of other food items in three ways. First, there was a shift away from the consumption of foods with a shorter shelf life towards foods with a longer shelf life (canned food, frozen food and grains). Second, there was a shift away from the consumption of fast food towards the consumption of food prepared at home. Lastly, there was a shift away from dietary foods (fresh produce) towards consumption of staple foods (grains).

The empirical results showed that larger households were more likely to have consumed less food during the COVID-19 pandemic than smaller households were. This is attributable to an increase in food prices and the high unemployment rate, since most respondents with a larger household size were more likely to have been unemployed. Therefore, regulations for food prices and employment creation should be put into place to increase rural households' level of food affordability. The further results of this study show that rural households with a higher number of employed people were more likely to have consumed greater amounts of food during the COVID-19 pandemic. Therefore, the South African government should design strategies or policies that would focus on increasing the number of employed people in a household, particularly in rural households. For example, a policy could aim at having at least an average of 3 people being employed in a household, since the greater the number of employed people in a household, the higher the food consumption frequency within that household would be.

Rural households that were headed by unemployed consumers were more likely to have consumed greater amounts of food in the circumstances of this study, relative to those that were headed by unemployed consumers. Therefore, this study recommends a continuation of these social safety net programmes so as to enhance the prospects of appropriate food consumption by rural households.

Households that received social relief grants are more likely to have consumed less food during the COVID-19 pandemic, as compared with those that did not receive social relief grants. This is attributed to the finding that most of the households under study did not receive the Social Relief of Distress Grant. Therefore, the government should expand the Social Relief of Distress Grant to qualifying households in order to enhance their capacities for food consumption.

The results further proved that rural households that had received food parcels were more likely to have consumed more food during the COVID-19 pandemic than those who had not received food parcels. Therefore, the government should continue distributing food parcels to the poor rural households, as food parcels contributed towards increasing food consumption frequencies during COVID-19.

Rural households that indicated that they had purchased food from restaurants are more likely to have consumed more food during the COVID-19 pandemic than those who did not purchase food from restaurants. Therefore, restaurants should be allowed to remain open, following all the COVID-19 protocols, during the pandemic as the closure of restaurants decreases the food consumption frequencies in rural households. Households that had participated in bulk buying were more likely to have consumed more food during COVID-19, compared with those that did not participate in bulk buying. Therefore, bulk buying should be encouraged, as people can purchase food products at lower prices, as compared with when purchasing in small quantities. This would increase the amount of food that households can purchase, as compared with buying a single product, and would ultimately increase the consumption of food by rural households. However, it is acknowledged that bulk buying could lead to supply shortages. Therefore, retailers could overcome this by limiting the number of food items that each customer is permitted to purchase.

Delimitations and areas for further analysis

While the study objectives have been achieved and the implications have been highlighted, the study could be extended in three areas. The first area involves extending the research to the national level in order to enable a generalisation of the findings. This could be achieved by investigating food consumption behaviours across the nine provinces of South Africa, including the rural, peri-urban and urban areas. However, it should be noted that, while the data were collected from one village in South Africa, the key findings are similar to those observed in other countries, in the following respects. A shift was observed away from the consumption of food with a shorter shelf life towards foods with a longer shelf life (Italy and Germany), a shift was observed away from the consumption of fast food towards the consumption of food prepared at home (the US), and a shift was observed away from dietary foods towards consumption of staple food (Slovenia and the US).

The second area for an extension of this study requires the inclusion of other factors that might affect food consumption behaviour, but which were unaccounted for in this study. This includes factors associated with grocery delivery services, food safety, eating/drinking habits and dietary requirements. The third area involves analysing the food consumption behaviours according to the individual lockdown levels (i.e. Alert Level 5 through to Alert Level 1), as food consumption behaviour could have changed as the lockdown restrictions were relaxed, as we moved down through to the lower levels.

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