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DETERMINANTS OF FOOD SECURITY AMONG RURAL HOUSEHOLDS IN NIGERIA: USDA FOOD INSECURITY EXPERIENCE-BASED MEASUREMENT SCALES (FIEMS) APPROACH

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Abstract: this study was carried out to estimate the extent of food insecurity and its determinants among rural households in Oyo west and Oyo east Local Government Area, Nigeria. Data for this study was obtained from 180 rural households through the use of structured questionnaire, the datawas analysed with descriptive techniques and aless restrictive multinomial logistic regression analysis, the result revealed that most of the rural households are food insecure as they measure high on the food insecurity scale. Age, sex, marital status, access to credit, dependency ratio, household size, ownership of farmland and farming experience significantly influence food security categories, the study concluded that married households headed by females are more food secure than households headed by males, increase in age of the household heads increases the likelihood of being food secure, access to credit facilities also increase the likelihood of being food secure, increase in family size and dependency ratio reduces the likelihood of being food secure, the study recommended thatthere should be provision and proper monitoring of credit facilities to small scale farmers in other to increase their scale of operation and food security status, policy measures directed towards family planning to reduce household size to that which the household can adequately cater for should be given adequate attention.

Key words: Food, Food Security, Food Insecurity, USDA, Multinomial Logistic.

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Introduction

Food is no doubt the most basic of all human survival needs, food is any edible substance consisting of nutritive components which when consumed sustains life, generates energy and provides growth, maintenance and health of the body, FAO (2015) define food security as a condition when all people at all times, have physical, social, and economic access to

sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food insecurity on the other hand arises when there is uncertainty or restricted availability of nutritionally adequate and safe foods in socially acceptable ways (FAO, 2000).

Food insecurity is a major problem facing the world, FAO (2017) estimated that almost 1billion people are chronically malnourished and food insecure around the world, majority of these people are found in developing countries most especially in Asia and Africa, according to African Food Security Briefs (AFSB, 2011), approximately one-third of the people in sub-Saharan Africa are undernourished.Shala and Stancey (2012) found out that the average amount of food available per person per day in the region was 1,300 calories compared to the world wide average of 2,700 calories, however, achieving sustainable economic development in developing countries will continue to be a delusion without well-nourished and healthy people, food secure people constitute a pool of potential that is capable of transforming a nation into a developed state but this may not occur if their health is compromised by nutritional deficiencies (Akereleet al., 2013).

Nigeria prides itself as the giant of Africa with the largest economy in 2014, about 70% of her population are living below the poverty line and has risen from a low poverty level status in the 1960's to become the country with the highest poverty level in the world (Olawale, 2018). The Food insecurity among rural and low income urban households in Nigeriais 71 % and 79 % respectively (Orewa and Iyangbe2010; Akereleet al., 2013).The Global Food Security Index (GFSI) of the Economist Intelligence Unit ranked Nigeria as the 80th among 105 countries with food affordability, availability and quality. According to the Index, Nigeria recorded weak scores in the areas of public expenditure on agricultural research and development, (0.0); presence of food safety net programmes, (0.0); gross domestic product per capita, (3.0); proportion of population under global poverty line (9.6); food consumption as a share of household expenditure; (9.6) and protein quality (12.8) (Ahmed et al., 2015). As pointed out by Matemilola and Elegbede (2017), food insecurity in Nigeria was driven by insufficient food production, gender inequality, inefficient policies, corruption, conflict, civil insecurity, climate change, natural disasters and low technology for processing and storage.

Agriculture is the mainstay of Nigeria economy as over 70% of her active population is gainfully employed in the sector (Muhammed-Lawalet al., 2015), the sector had suffered neglect since the discovery of crude oil in the 60's and had failed to contribute significantly to food security, poverty

alleviation, women empowerment and improved human nutrition through the provision of balanced diets, however, efforts are now been made by government to restore agriculture back to its original status before the oil boom and stamping out food insecurity (Ojo and Adebayo, 2012), various programsand policy frameworksare designed to address food insecurity and malnutrition in Nigeria, these include; the National Accelerated Food Production Project(NAFPP), Operation Feed the Nation (OFN), Agricultural Development Programme (ADP), Structural Adjustment Programme (SAP), National Poverty Eradication Programme (NAPEP), National Economic Empowerment and Development Strategy (NEEDS), MillenniumDevelopment Goals (MDG), Agricultural Transformation Agenda (ATA) and Agricultural Promotion Policy (APP). However, these programmes as noted by Akinyele (2009) have recorded few successes, with the lacklustre performances attributed largely to poor targeting of interventions. Nevertheless, proper identification of the most vulnerable households and better understanding of the extent and quality of food insecurity experienced by the people will help to achieve desirable outcomes, it is on this background this research is carried out, although there are growing literatures on food security and its determinants in Nigeria, available study such as Olayiwolaet al., (2017), Ubokudumet al., (2017), Ahmed et al., (2015) and Akereleet al., (2013) have measured food security using a benchmark and these approaches failed to measure the extent of the severity of food insecurity among households, besides, the study conducted by Fakayodeet al., (2009) use the USDA approach to measure the extent of food insecurity among rural households in Ekiti but failed to estimate the determinants of the food security categories, apart from the study above, there is no recent and related studies that have analyse the determinants of food security among rural households using the USDA approach particularly in Oyo state, this study would therefore measure food insecurity using a more intensive approach which measures measure the extent of the severity of food insecurity among households. However, this study would specifically describe socioeconomic characteristics of the rural households, determine level of food insecurity among rural households and estimates the determinants of food security level among rural households in the study area.

Methodology

Study Area

The study was conducted in Oyo west and Oyo east local government area of Oyo state, Nigeria. Oyo state is an inland state in south-western Nigeria, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly

by the Republic of Benin.Oyo West is a Local Government Area in Oyo State, Nigeria. Its headquarters are in the town of Ojongbodu. It has an area of 526 km? and a population of 136,236 at the 2006 census, Oyo east is bounded to the north-west by Atiba local government area, to the north-east by Ori-ire local government area, to the east by Ogo-Oluwa local government area, to the south by Afijio local government area and to the west by Oyo west local government area, its covers an area of 144km2 and a population of 123,846 at the 2006 census. Agriculture is the main occupation of the people of Oyo west and east, the climate of Oyo west and east favours the cultivation of crops like; maize, yam, cassava, millet, rice, plantains, cocoa, palm produce, cashew etc.

Sampling Techniques and Sample Size

A multi-stage sampling techniques was used for this study, the first stage involved a random selection of Oyo west and east local government areas out of the thirty-three local government areas in Oyo state, the second stage involved a purposive selection of three villages from each of the selected local government areas. Awosan, Ajagba and Irepodun were villages purposively selected from Oyo east local government area while Onilefun, Idi-araba and Iluaje villages were purposively selected from Oyo west local government area, the third stage involves a purposive selection of thirty rural households from each of the purposively selected villages, making a total sample size of 180 rural households, however, purposive sampling techniques was employed in this study as there was no enough information on sample frame of rural households in the study area.

Source of Data and Method of Data Collection

Data for this study was obtained from primary source, data was collected from rural households through the use of structured questionnaire to obtain information from the rural households, the information collected were on their socioeconomic characteristics such as; age of household heads, level of education, gender, household size, income, years spent in school, etc. data was also collected on food insecurity experienced by rural households in the last 30 days as well as their frequency of occurrence.

Analytical Techniques and Model Specification

The data collected from the field was analysed using descriptive techniques and inferential techniques, the descriptive techniques used were; frequency counts, percentages, standard deviation and means, the inferential techniques used was multinomial regression analysis.

Food Security Analysis

The food security status of the rural households was measured using the United State Department of Agriculture (USDA, 2000) food security questionnaire core module; USDA categorizes households using

a constructed food security scale that ranges between 0 and 10 for households without children (<17years) and between 0 and 18 for households with children (<17years).

Table 1: Eighteen(18) Households' Food Security Items

S/No	Questions/Statements	NT	ST	OT
1	We were worried our food would run out before we got money to buy more			
2	The food we bought just didn't last and we didn't have money to get more			
3	We couldn't afford to eat balanced diet			
4*	We relied on only a few kinds of low cost food to feed the children			
5*	We couldn't feed the children a balanced meal			
6*	The children were not eating enough because we just couldn't afford enough food			
7	Did some adults ever have to eat less than you felt you should eat because there wasn't enough money to buy food?			
8	How often did this happen in the last 12 months?			
9	Did some adults ever have to eat less than you felt you should eat because there wasn't enough money for food?			
10	Were some members ever hungry but didn't eat because you couldn't afford enough food?			
11	Did some members ever lost weight within the last 12 months because there wasn't enough food?			
12	Were there ever a time within the last 12 months that some adults could not eat for a whole day because there wasn't enough money to buy food?			
13	How often did this happen in the last 12 months?			
14*	Did you ever have to cut the size of some of the children's meal within the last 12 months because there wasn't enough money to buy food?			
15*	Did any of the children ever had to cut the size of some of the children's meals within the last 12 months because there wasn't enough money to buy food			
16*	How often did this happen in the last 12 months?			
17*	In the last 12 months, were the children ever hungry but you just couldn't afford more money?			
18*	In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?			

Note: NT= Never true, ST= Sometimes true, OT= Often true
**Not applicable to households without children.*
Source: USDA Guide, 2000

Households are classified into food security status categories based on the number of food-insecure responses to the questions consistent with statistical evidence that this number reflects the level of food hardship experienced by the family. The four categories of household food security are;

I. High food security (HFS): if

households reported fewer than 3 food insecure responses for households with or without children.

II. Marginal Food security (MFS): if households reported more than 2 but fewer than 8 food-insecure responses for households with children and more than 2 but fewer than 6 food insecure responses for households without children.

III. Low food security (LFS): if households reported more than 7 but fewer than 13 food-insecure responses for households with children and more than 5 but fewer than 9 food-insecure responses among households without children.

IV. Very low food security (VLFS): if households reported more than 12 food insecurity responses among households with children and more than 8 but fewer than 11 food insecurity responses among households without children.

Table 2: USDA Food Security Classification

Status	Numbers of Affirmative Responses	
	Households with Children	Households without children
High Food Security	0-2	0-2
Marginal Food Security	3-7	3-5
Low Food Security	8-12	6-8
Very Low Food Security	13-18	9-10

Source: USDA, 2006.

Households response to each of the questions was first coded as either affirmative or negative, each question had three response categories never true, sometimes true and often true.Sometimes true and often true were considered affirmative response because they indicated that the condition occurred at some time during the period covered by the study, however, the distinction between the three affirmative responses was not used in the scale.

Multinomial Logistic Regression Analysis

Multinomial logistic regression was used to analysed the determinants of food security of the rural households, multinomial logistic regression are used to model processes that involve a single outcome among several alternatives that can be ranked, though the food security is an ordering with severity increasing from households that are highly food secured to those that have very low food security, however, using a less restrictive multinomial logit model was considered appropriate than using an ordered logit because ordered logit involves estimating specific cut points, but the determinants of food security in the model was expected to affect the food security categories differently.

The multinomial logit model determines the probability that household i experiences one of the j outcomes of high food security, marginal food security, low food security and very low food security, the probability is given by;

$P_{ij}= E (Y_i=j/X_i) = F (\alpha+\beta_iX_i), j=0, 1…3$ **1**

= **2**

Where;

$Z_i= \alpha+\beta_iX_i+e_t$ **3**

$$P_{ij} = \frac{e^{Zi}}{1 + \sum_{j=1}^{3} e^{Zi}}$$ **4**

Where;

$P_{ij}= E (Y_i=j/X_i)$ is probability of the reference category.

$P_{ij}$is the probability of being in each of the groups compared to the reference group.

Where Y_i is the food security outcome experienced by household i

β_i is the set of coefficient to be estimated and

X_i is the set of explanatory variables which are;

X_1 is the sex of the household head (1= male, 0=female)

X_2 is the age of household head (years)

X_3 is the marital status of the household head (1=married, 0=otherwise)

X_4 is the household size (number of individuals)

X_5 is the number of years of education (years)

X_6 is the ownership of farm (1=own farmland, 0=otherwise)

X_7 is the farming experience (years)

X_8 is the income from non-farm source (□)

$X_9$is the access to credit (1=access, 0=otherwise)

X_{10} is the dependency ratio (ratio of inactive labour force i.e. age less than 15 and above 65 to the active labour force i.e. age between 15 and 65 within a household).

$e_t$is the disturbance term.

For a comprehensive interpretation of the coefficients of the multinomial logit, Gujarati (2004) and Green (2005) suggested the derivation of the marginal effects of the independent variables. According to Green (2005), by differentiating equation (2), the marginal effect is obtained as;

$$\delta_j=\frac{\partial Pi}{\delta Xi}= P_j[\beta_j-\sum_{k=0}^{j} Pk\beta k] = P_j[\beta_j-□] \quad (5)$$

However, in other to estimate the model, one of the outcome variables had to be omitted and defined as the base category. In this study, very low food security was chosen as the benchmark to which other food security levels were compared.

Results and Discussion

Socioeconomic Characteristics

The result of the socioeconomic characteristics revealed that majority (61.67%) of the rural farming households are headed by males, the dominance of males over their female counterparts may be because most farming activities requires more strength which most females may be able to provide, this corroborates the findings of Ahmed et al., (2015), most (25%) of the rural household heads are within 31-40years of age with mean age of 49years, this implies that majority of the household heads are still very agile, energetic and are within their productive age and this may influence their food security status positively, this result supports the findings of Olayiwolaet al., (2017), majority (89.44%) of the rural farming household heads are married, this implies that most of the household heads are matured and responsible to cater for their households as well as have a clear knowledge of their wellbeing, there is also an implanted sense of responsibility as marital status prompts commitment to business because of the family needs that must be met and this would subsequently enhance productivity, this result is in line with the findings of Ayoade and Adeola (2012). Most (43.89%) of the rural farming households had between 3-6persons in their households with a mean household size of 7persons, this implies most of the household heads had a fairly large household size so that they could employ household labour on their farms, this result is in line with the findings of Ezeibeet al., (2015), most (37.78%) of the rural farming households has less than 10years experience with mean farming experience of 19years, thisimplies that most of the household heads had enough experience about farming and this may influence their productivity positively and this may increase their income as well as their food security status, this corroborates the finding of Ambaliet al., (2012).

Table 3: Distribution of Respondents According to their Socioeconomic Characteristics.

Variable	Frequency	Percentage	Mean	Standard deviation
Sex				
Female	69	38.33		
Male	111	61.67		
Total	180	100.00		
Age				
≤30years	13	7.22	49	12.85
31-40years	45	25.00		
41-50years	42	23.33		
51-60years	43	23.89		
>60years	37	20.56		
Total	180	100.00		
Marital status				
Single	2	1.11		
Married	161	89.44		
Widow	11	6.11		
Divorce	6	3.33		

Total	180	100.00		
Household size				
1-3persons	26	14.44	7	2.84
3-6persons	79	43.89		
6-9persons	51	28.33		
9-12persons	19	10.56		
>12persons	5	2.78		
Total	180	100.00		
Farming experience				
≤10years	68	37.78	19	15.19
11-20years	44	24.44		
21-30years	27	15.00		
31-40years	21	11.67		
>40years	20	11.11		
Total	180	100.00		

Source: Field Survey, 2018.

Food Security Category

The USDA food security core module questionnaire was used to categorize households into four food security level which are; high food security, marginal food security, low food security and very low food security, the result on table 4revealed that majority (66.67%) of the households are in the very low food security level, 1.67% of the households are in the high food security category, 3.89% of the households are in the marginal food security category while 27.78% of the households are in the low food security category, this implies that a very large proportion of the households are in the very low food security category, the high food insecurity level in rural households in Nigeria is very alarming despite the fact that the bulk of food produced comes from rural areas, this result is consistent with the findings of Ayoade and Adetunbi (2013) that reported that the food insecurity among farming households in south western Nigeria was about 65%.

Table 4: Food Security Category

Food Security Category	Frequency	Percentage
High Food Security(HFS)	3	1.67
Marginal Food Security (MFS)	7	3.89
Low Food Security (LFS)	50	27.78
Very Low Food Security (VLFS)	120	66.67
Total	180	100.00

Source: Field Survey, 2018.

Determinants of Food Security

Determinants of High Food Security among Rural Households

The Waldchi-square revealed that the variables in the model are fit to explain the determinants of food security among the rural households, also the probability of chi-square revealed the overall significance of the model at 1% probability level ($p<0.01$). The result on table 3 below showed that sex, marital status,

access to credit and dependency ratio significantly affect high food security category relative to very low food security category, the marginal effect of sex showed that food security status of male headed households in HFS households decreases by 12.4%and it is significant at 10% probability level ($p<0.1$), this result is contrary to the findings of Ahmed et al., (2015) that found out that female headed households are more likely to be food insecure because they were mostly saddled with the responsibility of home keeping and raising children which thereby limits their engagements in some income generating activities compared to their male counterparts. The marginal effects of the marital status showed that the food security status of married households in HFS is likely to increase by 32.9%and it is significant at 1% probability level ($p<0.01$), this implies that married household among HFS are more food secure than their counterparts, this is basically because couples put their resources together which could generate more income than their counterpart, hence making them food secure, this corroborates the findings of Ubokudomet al., (2017), the marginal effect of the coefficient of credit access shows that the food security status of HFS households that have access to credit is likely to increase by 32%than their counterpartsand it is significantat 5% probability level ($p<0.05$), the marginal effects of the coefficient of dependency ratio shows that the food security status of HFS households would likely decrease as a result of increase in dependency ratio, this implies that an increase in dependency ratio by one member would likely results to 46.8% decrease in food security status of HFS households, this results corroborates the findings of Bigstenet al., (2002) and Ubokudomet al., (2017).

Table 5: Determinants of high food security among rural households

High Food Security	Variables	Coefficient	Standard Error	t-value	Marginal effects
	Sex	-7.211*	3.975	-1.810	-0.124
	Age	-0.122	0.130	-0.940	-0.002
	Marital status	19.206***	6.735	2.850	0.329
	Household size	0.499	0.319	1.560	0.009
	Years of education	-0.641	0.542	-1.180	-0.011
	Ownership of farmland	-2.886	1.916	-1.510	-0.049
	Farming experience	-0.242	0.250	-0.970	-0.004
	Non-farm income	0.000	0.000	-1.620	0.000
	Access to credit	1.874**	0.907	2.070	0.032
	Dependency ratio	-27.283*	15.631	-1.750	-0.468
	Constant	9.354	8.412	1.110	
	Prob> chi^2	0.0000			
	Pseudo R^2	0.2025			
	Wald $chi^2(30)$	700.96			
Very low food security	Base Category				

Source: Field Survey, 2018.
****P< 0.01, **p< 0.05, *p< 0.1*

Determinants of Marginal Food Security among Rural Households

The result on table 4 below showed that sex, age, marital status, household size, ownership of farmland and farming experience significantly affects the food security status of marginal food secure households relative to being in very low food secure households, the marginal effects of the coefficient of sex showed that food security status of male headed households in the MFS households decreases by 7.44%and it is significant at 1% probability level ($p<0.01$) compared to their female counterparts, this results is contrary to the findings of Ahmed et al., (2015), the marginal effects of the coefficient of age showed that the food security status of marginal food secure households increase as the age of the household heads increases, this implies that as the age of MFS household heads increases by 1year, the food security status of MFS households would probably increases by 0.48%, this result is consistent with the findings of Arene (2008), the marginal effects of the coefficient of marital status showed that the food security status of married household heads in MFS is likely to increase by 44.24%and it is significant at 1% probability level ($p<0.01$), this implies that married household heads among MFS category are more food secure than their counterparts, this is in agreement with the findings of Ubokudomet al., (2017), the marginal effects of the coefficient of household size showed that increase in household size increases the probability of being poor among MFS households, this implies that if the size of the household increases by 1 person, the food security status of MFS households would decreases by 2.48%, this is so because large household size affects availability of food per head in the family, this result is in line with the findings of Adebayo (2012). The marginal effects of the coefficient of ownership of farmland showed that households that own their farmland among MFS category are less likely to be food secure and it is significant at 5% probability level ($p<0.05$), this implies that the food security status of MFS category decreases by 1.21%, the marginal effects of the coefficient of farming experience revealed that as the farming experience increases the probability of being food insecure among MFS households increases, this implies that if the farming experience increases by 1 year the probability of being food insecure increases by 0.36% among MFS households.

Table 6: Determinants of Marginal food security among rural households

Marginal Food Security	Variables	Coefficient	Standard Error	t-value	Marginal effects
	Sex	-2.871***	1.069	-2.690	-0.0744
	Age	0.166**	0.071	2.340	0.0048
	Marital status	16.400***	1.082	15.150	0.4424
	Household size	-0.883*	0.481	-1.830	-0.0248
	Years of education	-0.175	0.137	-1.280	-0.0045

	Ownership of farmland	-0.483**	0.224	-2.160	-0.0121
	Farming experience	-0.127*	0.071	-1.780	-0.0036
	Non-farm income	0.000	0.000	0.120	0.0000
	Access to credit	0.513	0.756	0.680	0.0104
	Dependency ratio	-0.338	2.456	-0.140	0.0239
	Constant	-18.099***	2.212	-8.180	
	Prob> chi2	0.0000			
	Pseudo R^2	0.2025			
	Wald chi2(30)	700.96			
Very low food security	Base Category				

****P< 0.01, **p< 0.05, *p< 0.1*

Determinants of Low Food Security among Rural Households

The result on table 5 below showed that farming experience and dependency ratio significantly affects the food security status of low food secure households relative to being in very low food secure households, the marginal effects of the coefficient of farming experience revealed that as the farming experience increases the probability of being food secure increases among low food secure households and it is significant at 10% probability level (p<0.1), this implies that if the farming experience increases by 1 year, the probability of being food secure would increases by 0.77% among LFS households relative to VLFS category, the result is in consonance with the findings of Oluyole(2009)and Ahmed et al., (2015). The marginal effects of the coefficient of dependency ratio shows that the food security status of LFS households would likely decrease as a result of increase in dependency ratio, this implies that an increase in dependency ratio by one member would probably results to 41.41% decrease in food security status of LFS households, this results corroborates the findings of Bigstenet al., (2002) and Ubokudomet al., (2017).

Table 7: Determinants of low food security among rural households

Low Food Security	Variables	Coefficient	Standard Error	t-value	Marginal effects
	Sex	0.015	0.371	0.040	0.0038
	Age	-0.018	0.027	-0.670	-0.0037
	Marital status	-0.244	0.583	-0.420	-0.0528
	Household size	-0.013	0.095	-0.140	-0.0024
	Years of education	0.016	0.035	0.470	0.0033
	Ownership of farmland	0.128	0.079	1.620	0.0257
	Farming experience	0.038*	0.021	1.850	0.0077
	Non-farm income	0.000	0.000	0.040	0.0000
	Access to credit	0.385	0.304	1.270	0.0771
	Dependency ratio	-2.066**	0.982	-2.10	-0.4141
	Constant	0.631	1.667	0.38	
	Prob> chi2	0.0000			
	Pseudo R^2	0.2025			
	Wald chi2(30)	700.96			
Very low food security	Base Category				

***p< 0.05, *p< 0.1*

Conclusion and Recommendation

Proper identification and better understanding of the extent of food insecurity and its determinants particularly among rural households is a step towards proffering solution to this menace, the result of this study revealed that most of the nation's rural households are food insecure measuring high on the food insecurity scale, this is evidenced by the food security categories in the study area, the study revealed that sex, marital status, access to credit and dependency ratio significantly influence the food security status of highly food secure households. Sex, age, marital status, household size, ownership of farmland and farming experience significantly influence the food security status of marginally food secure households while farming experience and dependency ratio significantly influence the food security status of low food secure households, the study concluded that; married households headed by females are more food secure than households headed by males, increase in age of the household heads was found to increase the likelihood of being food secure, access to credit facilities also increase the likelihood of being food secured while increase in family size and dependency ratio reduces the likelihood of being food secure, this study recommended that programmes and policy that would create job opportunities should be targeted towards most vulnerable groups (women and youths) as this would help to reduce theirdependency and increase their food security status, there should be provision and proper monitoring of credit facilities to small scale as this would go a long way in increasing their scale of operation and food security status, adequate attention and priority should be given to policy measures directed towards family planning to reduce household size to that which the household can adequately cater for by the government.

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