



## Abdelsami Musa Ibrahim\*

Livestock Marketing and Resilience Programme,  
(LMRP)/IFAD, Sudan

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\***Corresponding author:** Abdelsami Musa Ibrahim,  
Livestock Marketing and Resilience Programme,  
(LMRP)/IFAD, Sudan,  
E-mail: [abedokosti2222@gmail.com](mailto:abedokosti2222@gmail.com)

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## Case Study

# Food Behavior and Consumption Pattern in Rural White Nile of Sudan

## Abstract

Food consumption and nutrition intakes it seem as a major problem in rural area of White Nile state in Sudan, in spite of this area is rich of food production resource, through this study we had tried to know the pattern of food consumption and nutritional intaking in this area by taking six groups of food. The measurement of food security in the State was assessing through a household survey data. The author used Linear Approximate Almost Ideal Demand System (AL-AIDS) to estimate food price and expenditure elasticities and also used the nutrient demand model, in addition to the impact of the household characteristics on food and nutrition demand behavior; the result in term of cross price elasticity showed positive sign indicating response of substitution, in addition to the expenditure elasticities for all food groups showed positive signs excluding the oil group; generally, according to the nutrient demand model the result showed the household characteristics influence the nutrition intaking for all members of family, in other hand the regional factor appears to have negative impact between localities within the study area; finally, strongly recommended that the federal government strategy and policies for food security will be directed toward to the food supply and designed to increase income and procurement power.

## Introduction

Food consumption and nutrition intake are very important content for food security. Where Over all country the Sudanese Federal Government are concerned on how to improve the health and nutritional status of people, FMOH [1], and this is vital to Sudan development. It's well known that Sudan has enormous potential in terms of natural and human resources FAO (2005); but it's not on the correct track due to several reasons to meet the Millennium Development Goals "MDG" by 2015, UNICEF [2]. Recently dependent on some studies from, SHHS [3] the nutritional indicators in Sudan found that, as Millennium Goals indicator 1.8% on hunger reduction, almost 31% of children under the age five years were underweight; 48% of children under the age five years were stunted and 18.1 % of children under five suffered from moderate or severe acute malnutrition. Majlesi et al. (2003a) [4] reported there are some of social household factors in the developing countries influence food consumption and nutrition to the children growing up such as; number of family member, education level, parents or household head job, socio-economic status, their knowledge about proper nutritional methods, prenatal care, household head age, mothers weight, newborns sex, etc.

There are some previous studies displayed food consumption and nutrition as on Musaiger [5] study focuses on some factors e.g. socio-cultural and economics factors

affecting food consumption in the Arab countries, in other hand, some Sudanese researchers mentioned food consumption in Sudan, but these studies were not concentrating mainly on rural areas which have several variations in agro-ecosystem. As Samar et al. [6], where she wrote on what is determine the dietary food consumption pattern for rural household in the dry land sector of Sudan, but she ignore the other un dry region as in many parts of White Nile State of Sudan. For that we tried to concentrating just on rural household because rural people representing the vast number of the state population, so it could give an indicator about the food consumption and nutrition in rural areas of the Sudan.

People in developed countries consume about 3 to 4 times as much meat and fish and 5 to 6 times as much milk products per capita as in developing Asia and Africa. Yet, meat, milk, and fish consumption per capita has barely grown in the developed countries as a whole over the past 20 years. Growth in per capita consumption and production has occurred in developing regions such as developing Asia, where income has increased from a low level and urbanization is rapid. By 2020, according to projections by IFPRI's IMPACT model, the share of the developing countries in total world meat consumption will rise from 47 percent currently to 64 percent. The net impact on food access for the poor of the world will depend on their role as producers of meat, milk, and fish, their role as consumers, and their need for protein. The amount of cereals

per capita consumed directly by rural people will decline as they diversify their diets into animal proteins, but feed use will increase greatly. Available evidence suggests that on balance poor consumers in developing countries will probably be better off [7].

Food consumption behavior in White Nile State of Sudan determined by a combination of factors where WFP [8], reported food consumption in White Nile is more convenient, that about 99% of rural households in the acceptable food consumption category; on more than 1% of rural peoples in the State are in the borderline food consumption categories; this is due to the some main factors e.g., lower of the cereal grains prices supported by 2010 season harvested and the availability of wage agricultural labor opportunities that contribute to households income. In other hand, the main objective of this study to assess the current situation of food behavior and consumption pattern.

## Methodology

Here, before the econometric analysis on food and nutrition demand, food consumption demand we start with the analysis by social-economic groups (social factors) as in table 1.

Age is continuous variable; its mean is 50 years old. The sample is separated into two groups. The group for household head with younger age consumes more sorghum, wheat, meat and milk; while less millet, egg and lobia; anyway rice and sugar almost are the same level per capital.

Education (denoted as edu) is a dummy variable, when household head never accepted education, edu is assigned the value "0", or it should be assigned the value "1". By the group with "edu=1", the family consume more sorghum, lobia and meat, while less millet, egg and wheat with the illiteracy of household head group; beside oil, milk and sugar almost at the same level consume per capita.

Gender is a dummy variable, the data set into two categories as a dummy variable; where male is denoted as "1" and female "0", so 310 of household headed by men and they consume more sorghum, wheat, rice, meat, milk and sugar, in other hand they consume lee millet, lobia and oil; that compared with the household headed by women and for egg consumption almost in the same level.

Burden coefficient explain the family experienced severe burden that shared between family members, the data set into two groups one is ( $>2.75$  "greater than 3 persons") and the other group is ( $\leq 2.75$  "less than 3 persons"). The result shows the burden ( $\leq 2.75$  "less than 3 persons") group are consume more sorghum, millet, wheat, meat, milk and sugar; while consume less lobia; while they consume rice and egg at almost the same level per capita.

Children ratio "family children proportion" where data was set into two groups according to the family children proportion as in the first group ( $>.33$  "greater than .33 percentage") and the second group ( $\leq .33$  "less or equal .33 percentage"), where the first group consume more millet and rice in other hand consume less sorghum, wheat and milk; and consume lobia, oil, egg, meat and sugar at the same level of consumption per capita.

Self-sufficiency rate here looking for the ratio of the weight food that households produced and consumes by themselves, where data set in two groups one group is ( $sr >.23$ ) and other group is ( $sr \leq .23$ ); the result shows the first group ( $sr >.23$ ) consume more sorghum, millet, lobia, meat, egg, milk and sugar, while they consume less wheat, rice and oil.

The Distance between surveyed villages takes an indicator for the rural households' access to market and thus get their food; the data divided into two groups; one the distance is more than 10 km ( $dist >10$  km) and the other one is the distance equal or less than 10 km ( $dist \leq 10$  km) with taking into consideration

**Table 1:** Socio-economic factors and food consumption per capital of rural HHs.

The groups	sub_group	No. of Obs	sorghum	millet	lobia	wheat	rice	oil	meat	egg	milk	sugar
age	>50	155	114.4	9.2	10.8	23.3	7.6	9.4	23.3	1.4	64.9	18.6
	$\leq 50$	205	109.1	14	13.5	21.4	7.8	10.1	21.4	2.0	58	19.4
edu_women	$\leq 1$ , illiteracy	201	112.7	12.4	11.3	22.3	7.6	10.3	23.4	1.9	60.2	18.8
	$>1$ , educated	159	109.8	11.4	13.6	22.1	7.9	9.1	20.7	1.7	62.0	19.4
gender	1: male	310	112.7	11.2	11.6	23.3	8.2	9.2	22.7	1.8	62	19.3
	0: female	50	103.6	16.7	16.7	15.5	5.1	13.6	19	1.7	54.6	17.7
Size_hh	>7	134	107.8	13.4	10.7	20.1	9.6	8.8	23.4	2.1	45.5	17.3
	$\leq 7$	226	113.5	11.1	13.3	23.5	6.6	10.4	21.5	1.6	70.1	20.1
Burden coefficient	burdc $>2.75$	90	106.3	11.7	13.8	18.2	7.3	10.6	20.7	1.8	49.1	17.9
	burdc $\leq 2.75$	270	113.1	12	11.8	23.6	7.9	9.5	22.7	1.8	64.9	19.4
Children ratio	$>0.33$	193	107.1	12.6	12.5	20.7	9.1	9.8	21.9	1.9	56.4	19.2
	$\leq 0.33$	167	116.3	11.1	12.1	24	6.2	9.8	22.5	1.7	66.3	18.9
Self sufficiency	sr $>0.23$	162	113.5	14.8	14.1	20.5	7	9	25.1	2.2	65.5	19.5
	sr $\leq 0.23$	198	109.7	9.6	10.8	23.6	8.4	10.4	19.8	1.4	57.2	18.7
Distance	dist $>10$ km	225	112.1	12.7	12.7	20.9	8.0	10.7	22.2	2.1	55.0	18.9
	dist $\leq 10$ km	135	110.3	10.7	11.6	24.5	7.3	8.3	22.2	1.2	70.9	19.3

Data Source: the data collected by the author's survey.

the local market in the same village the distance equal “o” , and the rural household can take their food needs from the some markets for some remote villages. The result shoes household consumes more sorghum, millet, lobia, rice, egg and oil, while they consume less wheat and milk; also consume meat and sugar at the same level of food consumption.

Generally, the Sudanese food diet is essentially composed of cereal grains, milk, eggs, fruits, and vegetables. Where fruits and vegetables provide a good source of micronutrients, but meat supply including fish represent the other sources of micronutrients which is are limited, FAO [9].

### Food consumption & data of food groups

In this section, all data for food consumption is from household survey. In order to estimate food demand, the food is seperated to six groups, which include cereal and pulses (sorghum, wheat, rice, millet and lobia “cowpea”), meats (mutton, beef, chicken, fish and egg), milk (cow , sheep and goat milk), oil (peanut and sesame oil), vegetable (onion, cucumber, tomato, potato and etc. ) and sugar.

Food consumption is one of the most important issues on food security. Food consumption patterns are the main characteristics of the local culture, in the other hand food consumption patterns describe the local food availability in the any country. However, people’s knowledge attitudes and perceptions, traditions, culture, and other social organization are the significant factors that can influence food consumption patterns, Jenny and Egal and FAO [10,11].

The household data was collected from rural area, which is used to estimate the food demand through AIDS model. The goal of this study is to get price and expenditure elasticities, so that the economic regulation on food demand could be found.

Figure 1 explain the non-parametric estimation of the six groups of food “cereal grains and pulses including (sorghum, millet, wheat, rice and lobia), Meat, Milk, Oil, Vegetables, and Sugar” this is consumed by rural households in White Nile state of the Sudan. The shapes of the curves as sawn don’t indicate the linearity in budget shares; these food groups’ shares represent consumer behavior that had different level of expenditure on food. There was the variable used to explain the consumption demand as in table 2 below:

### Food demand model

Almost Ideal Demand system (AIDS) is the popular model to estimate price elasicities and income. In practice, the household income is difficult to collect in survey, so the income is often replaced by expenditure.

Conceding Engel Curve for 6 groups of food share in figure 1, most of the graph for food groups show approximate linear. So food demand model in this section also is used in form of Linear Approximate Almost Ideal System “LA–AIDS” model.

The LA–AIDS model is used more frequently than the nonlinear AIDS model [12–14]. The estimates from an LA–AIDS model would approach the estimates for AIDS except for

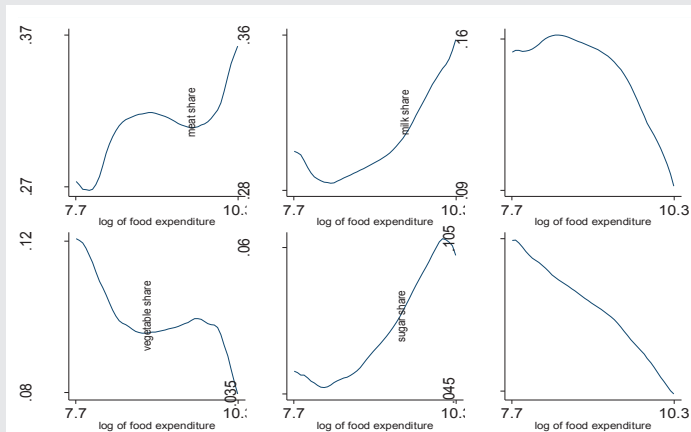


Figure 1: Explain the non-parametric Engel Curve for 6 groups of food share.

Table 2: Shows the definition of variables used.

Variable	Definition	observations	Mean	Std.Dev.
w_cp	Weight of cereal and pulses food share	360	0.31	0.09
w_meat	Weight of meat share	360	0.30	0.10
w_milk	Weight of milk share	360	0.15	0.08
w_oil	Weight of oil food share	360	0.10	0.06
w_veg	Weight of vegetable and potato food share	360	0.04	0.05
w_sugar	Weight of sugar food share	360	0.08	0.03
lnp_cp	Logarithm of cereal and pulses price	360	0.88	0.23
lnp_meat	Logarithm of meat food price	360	3.05	0.35
lnp_milk	Logarithm of milk food price	360	1.18	0.15
lnp_oil	Logarithm of oil food price	360	9.02	0.46
lnp_veg	Logarithm of vegetable and potato food price	360	9.24	1.23
lnp_sugar	logarithm of sugar food share	360	9.02	0.46

an intercept term, Green and Alston (1990). Although using Stone’s price index has been found to affect the approximation properties of the model with changes in the units of measurement Moschini [15], in the present study the usage of it has been found appropriate because of carefully choice of unchanging units of measurement for prices and quantities. In addition, Zellner’s (1962,1963), Iterative Seemingly Unrelated Regression (ITSUR) is considered because it is usually regarded as a better tool to improve the efficiency of the estimates [16–19].

$$w_i = a_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln(x / p) \tag{1}$$

Here Richard [20], mentioned as the same in currently study ( $w_i$ ) is the expenditure share of food, ( $p_j$ ) is the price of food commodity  $i$ ,  $X$  is the total expenditure within the food demand system over time, and ( $P$ ) is an overall price index. As in most empirical work using the AIDS, the price index, ( $P$ ), is approximated by the Stone’s price index Stone [21].

$$\ln p = \sum_j W_j \ln p_j \tag{2}$$

Here we used stone’s price index, referred to as linear approximate almost ideal demand system (LA/AIDS), where ( $P$ ) a price index is estimated,  $p_i$  is price for food items and ( $w$ )

is the weight of food consumed. In fact, by using Stone's price index as a proxy, the model becomes linear in parameters  $\alpha$ ,  $\beta$ , and  $\gamma$ , and become the LA-AIDS model [16,22,23].

Due to the above we generate:

$$\sum_j^n \alpha_i = 1, \sum_j^n \alpha_{is} = 1, \sum_j^n \beta_i = 0, \sum_j^n \gamma_{ij} = 0, \quad (3)$$

$$\sum_j \gamma_{ij} = 0 \text{ (Homogeneity)} \quad (4)$$

$$\gamma_{ij} = \gamma_{ji} \text{ (Symmetry)} \quad (5)$$

The adding up, homogeneity and symmetry restrictions were imposed (and one share equation was dropped from the system for estimation). The expenditure elasticity's ( $\eta_i$ ) and uncompensated price elasticity's ( $\epsilon_{ij}$ ) in the LA/AIDS model are generated by:

$$\eta_i = 1 + \frac{\beta_i}{w_i} \quad (6)$$

$$\epsilon_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i w_i}{w_i} \quad (7)$$

Here the  $\delta_{ij}$  equal to one when  $i=j$ , and is equal to zero in otherwise.

## Results and data analysis

According to the function (6) and (7), the relative price and expenditure elasticities in the table 3 as the following:

The cereal grains and pulses denoted as "cp" representing sorghum, millet, wheat, rice and lobia; meat group including goat, sheep, cow, chicken, ewes, egg and fish; the vegetables and potatoes denoted as veg; and sugar. The compensated own price and cross elasticity as well as the expenditure elasticity are shown in the table above. The signs of own prices of the grouped variables are consistent with the Hicksian theory (relatively inelastic showing negative signs): own price elasticity for sugar (-1.6), meat (-1.06), oil (-1.02), vegetable (-0.95), milk (-0.84) and grains and pulses (-.55).

In terms of the cross price elasticity, about half of its results presented in table 3 shows positive sign indicating response of substitution. The first five strongest substitution response to price among the cross price elasticity include the consumption of sugar for the price of oil (1.11), milk for sugar and the reverse (0.734 and 0.523 respectively), meat for sugar (0.33), meat for milk (0.25) and "cp" for oil (0.19); where it has similarity with Taljaard (2004) [24], reported that the food groups of beef and mutton in term of cross price elasticities appears positive signs as expected for substitute production that compared to the chicken and pork food groups demand price.

In the other hand, the expenditure elasticities of all the groups showed positive signs excluding oil group. More so, the entire group presented expenditure elasticity greater than one explaining that with a proportional change in prices there would be a greater proportional change in demand or purchase of these products except milk and oil.

## Data and its description

The food nutrition is consumption is one of the most important issues on food security as food demand. Bascally,

Sudan could produce food by itself, but sometimes there exists malnutrition or shortage of food.

Some reachers have estimate nutrient demand in household level. Awudu Abdulai and Dominique Aubert [25], used a moment-based instrumental variable approach used to analyze the determinate of nutrient demand in Tanzania, but less research about nutrient demand is published about Sudan.

Food nutrient exist in food itself, which includes carbohydrates, protein, fat, vitamin and minerals. Food Composition in table 4 explain the important nutrients (calories, protein and fat) in foods commonly eaten in Africa where it is matching with the food supply in Sudan, the local food items for which nutrient composition group data were not identified where imputed directly from foods of a similar description derived from the primary or secondary nutrient composition sources in other parts of Sudan. In some cases, food items were identified in primary or secondary sources, but the source may contain missing data for some nutrients.

Fisheries FAO [26], mentioned the tabulated nutritive values presented in the food composition table are derived from

**Table 3:** Shows uncompensated price elasticity and expenditure elasticities.

Food groups	Price elasticity of demand	Cross elasticity of demand						Expenditure elasticity
		cp	meat	Milk	oil	veg	sugar	
cp	-0.546	--	-0.110	-0.251	-0.060	-0.025	-0.055	1.049
meat	-1.058	-0.160	--	0.020	-0.187	0.024	0.173	1.192
milk	-0.840	-0.357	0.247	--	-0.047	-0.037	0.523	0.505
oil	-1.024	0.193	-0.163	0.030	--	0.020	1.106	-0.182
veg	-0.946	-0.269	0.119	-0.250	-0.104	--	0.121	1.334
sugar	-1.600	-0.616	0.332	0.734	0.120	0.026	--	2.311

**Table 4:** African food composition.

No.	Food Description	Food Calories /Calories	Protein /Grams	Fat /Grams
1	Sorghum	339	9.8	3.1
2	wheat	336	10.3	2.4
3	lobia	342	23.1	1.4
4	Rice	332	7.1	3
5	Millet	341	10.4	4
6	Potato	75.2	1.04	0.16
7	Vegetable	15.01	0.869	0.158
8	Mutton	201	12.8	16.3
9	Beef	199	15	15
10	Fish	53.56	9.77	1.3
11	chicken	241.6	14.4	20
12	egg	124.6	10.5	8.5
13	Milk	79	3.8	4.8
14	oil	883	0.1	99.8
15	Sugar	351	0	0
16	Peanut	275.25	14.1	4.65
17	Sesame	479	17	29.1

Data source Food and Agricultural organization (FAO).

actual analyses reported by various investigators and probably include most of the data of food group. Foods are grouped in the food table 4 in a manner suggested in the FAO "Program of Food Consumption Surveys," 1964, with the exception of nuts and seeds which are combined into one group.

The section above has analyzed household food demand, but doesn't mention nutrition in taking. This section will introduce food nutrition composition at first, and then using Generalized Moment Estimation Method (GMM) to establish the relationship between household nutrition intakes and demographic factors. This section will focus on main nutrient including calories, protein and fat.

Food consumption and nutrition in White Nile state of Sudan rely on the household capability to improve their nutrition situation that through household characteristic, demographics and position that no away to the SIFSIA [27], reported the last statewide nutrition survey was done as a part of the household health survey on 2006, and found that the Global Acute Malnutrition (GAM) rate in White Nile was 14.5% below the emergency threshold of 15%. In the same survey, the Severe Acute Malnutrition (SAM) rate was reported to be 3.6 percent.

In the table 5 the family, in which household heads are old, intakes less nutrition (calories, protein and fat) per capital compared to the younger age; housewife education influence their family nutrition in taking, the family with lower education intakes more nutrition per capital than higher education; the family, headed by male (gender=1), intake more calories and protein but less fat per capital than women head; the families with large size (more persons) intake less nutrition per capital than small scale size of family; families with high proportion of labors (lower burden coefficient) intake more nutrition per capital than higher burden coefficient; families with high ratio of children, intakes less nutrition compared to the families with lower children ratio; according to self-sufficiency group, families that have higher capability to produce more food have intakes more calories and protein, but less fat; family far away from market(distance) intake more calories and fat, but less protein.

### Household nutrition ratio

On one hand, Farmers produce food for example, planting crops such as sorghum, sesame, millet and etc.; or raising animals such as chicken, beef, goat, sheep and etc. It is complicated to talk if farmer could raise themselves or not, the reasons is that they have food by themselves or sail excess food in the market, and also buy food there. In order to measure the nutrition supply ability, the nutrition supply ratio is used in the function as in the following:

$$\text{nutrition}_{\text{ratio}} = \frac{\text{total\_nutrition\_produce}}{\text{total\_nutrition\_intak}} \quad (8)$$

Where  $\text{nutrition}_{\text{ratio}}$  is the nutrition ratio that household intaking; "total\_nutrition\_produce"

In table 6 shows the average of dietary nutrition intakes for all households in the study area, where it's denoted by "ration of energy intaking, ratio of protein intakig and fat

ratio intaking" the result indicate that household consume food rich of protein as in some food that household produced by themselves e.g. chicken, eggs, lobia, "sesame and peanut" for food, sorghum and some part of study area household also produce and consume wheat to get their nutrition demand.

In the other hand, rural farmer produce food with high energy for self-consumption, where household producing food like oil seeds "Peanut and Sesame", lobia "Cowpea", sorghum, millet, wheat, rice, chicken and eggs, these food considered as the food containing high energy, where it is agreed with WFP and FAO (2010) [28] reported food consumption and nutrition in White Nile is very good, with 100 % of urban households and 99% of rural households in the acceptable food consumption category.

Prior to 2009, oil seeds and meat were exported excessively as indicated in the FAOSTAT. On the other hand, the results indicate that the rural household generally can supply nutrition calories and protein.

### Nutrient demand model

The nutrient demand was expressed in the previous researches as in these examples of researchers e.g. [29-31], the total nutrient demand (N,) of the household is a function of household budget constraints, which depends on incomes and prices; as well as various indicators of the nutrient

**Table 5:** Shows household nutrition groups by household characteristics.

The groups	sub_group	No. of Obs	calories	protein	fat
age	<=50	205	2213	64	56.7
	>50	155	2186	63.8	54.8
edu_women	<=1, non-official education	201	2225	64.1	57.6
	>1, official education	159	2171	63.8	53.8
gender	1: male	310	2200	64.2	54.3
	0: female	50	2211	62.1	66
Size_hh	>7	134	2072	60.7	50.0
	<=7	226	2277	65.8	59.4
Burden coefficient	burdc>2.75	90	2096	60.3	54.8
	burdc<=2.75	270	2236	65.1	56.2
Children ratio	>0.33	193	2150	62.3	54.5
	<=0.33	167	2260	65.8	57.4
Self-sufficiency	sr>0.23	162	2244	67.3	55.2
	sr<=0.23	198	2166	61.2	56.4
Distance	dist>10 km	225	2220	63.7	57.5
	dist<=10 km	135	2170	64.4	53.1
Average		360	2201	63.9	55.9

**Table 6:** Shows the statistical analysis of nutrition producing.

Variable	Observations	Mean	Std. Dev.
ratio_energy	360	1.08	1.18
ratio_protein_ability	360	4.74	22.77
ratio_fat	360	0.82	1.14

requirements and tastes of household members and household characteristics. Consequently, the household demand for nutrients can be represented as in the below equation:

$$N_i = \alpha + \beta Z_i + \delta X_i + \mu_i \tag{9}$$

Where  $Z_p$  would be a vector of economic and demographic independent variables assumed to be measured accurately  $X_i$  the per capita household expenditure, and  $\mu_i$  the residual term. Specifically, the economic and demographic variables as in some household characters e.g. household size, age, gender... etc.

Foods embody positive attributes such as taste and essential nutrients, and negative attributes such as health risk associated with saturated fat and cholesterol Chern [32]. Demographic variables enter into the demand functions because they influence a consumer's efficiency in producing and consuming health inputs or attributes. Given that women are normally responsible for food production in the household, women's schooling is expected to have a positive effect on the intake of micronutrients and a negative effect on the intake of saturated fat and cholesterol.

### Results and Data Analysis

According to the model (9), the results list in the following table 7. Household heads characteristics in term of (age) seems statistically significant influence the demand for families nutrition. The coefficient on this variable is positive and appears to have an impact on the nutrition demand for all nutrition groups, in other hand the coefficient statistically significant for all nutrition; women schooling (edu\_woman) in the table the coefficient on the variable for women's education have negative impact to influence family nutrition for all nutrition group; we also found the household head gender is statistically

not significant with calories and proteins but significant with negative impact on fats.

The household size (size\_hh) appear to have an impact on the nutrition demand where it is positive with the family size, and the coefficient is statistically significant for all nutrition displayed in the table 7, this indicates that the larger family size have more nutrition intakes compared with the smaller family size; families with proportion of labor (Burdc) the coefficients are statistically not significant for all nutrition groups. Family children ratio (child\_ratio) is seems with the coefficients are positive and higher in calories and proteins compared with fats, these coefficients are statistically significantly larger in all nutritional groups.

Self-sufficiency group (sr) has higher coefficients on the variable self-sufficient is positive for all nutrition groups beside statistically significant with exception of fat; Families inhabiting far from markets (distance) the coefficient on this variable is positive and appears to have an impact on the nutrition demand for all nutrition groups, in other hand the coefficient statistically significant for all nutrition. From the coefficient on variables for price (sorghum and mutton) and food expenditure per capital, the results are consistent with the economic theory.

The coefficient of prices logarithm have negative impact to influence household nutritional intake. In all questions, per capital expenditure has a significantly positive coefficient for all nutrition intakes; the regional comparative between Kosti (d1) and other localities that appears to have negative impact on nutrient demand per capital between Ed-Duem (d4), Eljablean (d5) and Rabak (d6) localities respectively, in other hand the coefficients representing the coefficient statistically not significant for all nutrition groups.

**Table 7:** Shows instrumental estimates for nutrition demand.

variables	calories				Protein				Fat			
	Coef.	Robust Std.Err.	z	P> z	Coef.	Robust Std.Err.	z	P> z	Coef.	Robust Std.Err.	z	P> z
age	0.012	0.00	4.01	0.00	0.009	0.00	3.95	0.00	0.006	0.00	3.56	0.00
edu_woman	-0.031	0.04	-0.86	0.39	-0.021	0.03	-0.70	0.48	-0.013	0.02	-0.76	0.45
gend	-0.132	0.11	-1.21	0.23	-0.040	0.09	-0.46	0.65	-0.143	0.06	-2.40	0.02
size_hh	0.229	0.02	11.88	0.00	0.209	0.01	14.00	0.00	0.173	0.01	16.21	0.00
burdc	0.002	0.00	0.92	0.36	0.002	0.00	1.35	0.18	0.002	0.00	1.44	0.15
child_ratio	0.397	0.18	2.20	0.03	0.315	0.14	2.19	0.03	0.271	0.09	2.86	0.00
sr	1.195	0.31	3.82	0.00	1.209	0.26	4.58	0.00	0.170	0.13	1.29	0.20
dist	0.018	0.01	2.95	0.00	0.010	0.00	2.03	0.04	0.014	0.00	4.31	0.00
lnp01	-0.486	0.22	-2.24	0.03	-0.261	0.17	-1.51	0.13	-0.298	0.11	-2.73	0.01
lnp08	-0.747	0.18	-4.16	0.00	-0.647	0.15	-4.29	0.00	-0.211	0.07	-2.96	0.00
lny	2.249	0.09	26.10	0.00	1.725	0.07	23.84	0.00	1.563	0.04	44.13	0.00
-id2	0.132	0.13	1.02	0.31	0.065	0.10	0.67	0.50	0.081	0.07	1.13	0.26
-id3	0.052	0.11	0.46	0.65	0.028	0.09	0.31	0.76	-0.023	0.07	-0.32	0.75
-id4	-0.335	0.18	-1.89	0.06	-0.414	0.14	-2.90	0.00	-0.126	0.09	-1.44	0.15
-id5	-0.235	0.13	-1.84	0.07	-0.287	0.09	-3.07	0.00	-0.232	0.07	-3.14	0.00
-id6	-0.278	0.15	-1.86	0.06	-0.293	0.12	-2.49	0.01	-0.225	0.09	-2.60	0.01

Finally, as we discussing the result on Price elasticity of the food group demand, meat, oil and sugar are goods with elasticity, which means that the price change 1%, the demand will change less; and staple food (cp), milk and vegetables are inelastic, which means that the price change 1%, the demand of these food groups will change more. Also the result on cross elasticity of demand showed that if price of staple food (cp) increases, consumers reduce not only staple food itself, but also other groups; if price of meat increases, consumer will reduce meat demand more, and also reduce staple food (cp) and oil, but increase sugar, vegetable and milk; if price of milk increases, the milk consumption will decrease, and staple food (cp), oil and vegetable reduce, but added more sugar and meat; if price of oil increases, the oil consumption will decrease more, and meat consumption also decrease, but others demand will increase; if price of vegetable increases, staple food (cp), milk and oil also are decrease, but sugar and meat demand will increase; if price of sugar increases, sugar itself and staple food (cp) will decrease, but other food groups will increase; in the same way; and according to expenditure elasticities, if household income increases (suppose the proportionate increase in income is used for food expenditure), the luxury goods (sugar, vegetable, meat and staple food (cp)) will increase, the necessities goods milk also increase a little degree; but the oil is inferior goods, it will decrease when its price increases.

Generally, according to the cross elasticity of demand that could recommend as in the staple food (cp) price increasing will made itself and other food demand decrease; so it's better to have priority to make policies on price stability for the staple food (cp). According to section of nutrition demand, the same result could be got and the similar policies could be made; on the one hand, expenditure elasticities are larger than price elasticities for most of food groups excluding oil and milk, which means that income effect is much more useful than price effect. So government should give priority make policies to increase household income rather than to control price; according to the expenditure elasticity and price elasticities, government should have priority to make policies to encourage developing sugar and livestock industries.

## Conclusion

In this study we had estimate household nutrient focusing on the calories, protein and fat and ignoring vitamin and minerals; the (GMM) was used to estimate main nutrients; the nutrition intake of the young household head is higher; this indicates that in the near future these large young groups will become old household head demanding larger nutrition. Additionally, it is obvious that with larger household size, more nutrition would be demanded suggesting higher demand as population increases. The nutritional demand to a child is important as it support the healthy mental and physical growth. Also the results reviewed the infrastructures such as road influences the distance between markets which in turn affect nutrition demand. Generally, higher income induces more nutritional intake and inversely to this is the prices to nutritional demand.

Generally, we recommend the federal government strategy and policies for food security will be direct toward to the food supply and designed to increase income and purchasing power, especially of the poor vulnerable groups. These groups could be identified as rural or urban working poor; urban and rural displaced or handicapped, female-headed urban households, female head rural household inhabitants of marginal area, poor nomads, resource poor rural household and inhabitants of areas of conflict and civil insecurity. In other hand household nutrition producing had highly performance such as in energy intake, ratio of protein and staple food energy e. g, sorghum and millet.

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