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*Full Length Research Paper*

# Assessment of Food and Nutrition Security/Insecurity in Sudan Using Frequency and Severity of the Coping Strategies

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**Sudan experienced food and nutrition insecurity problem with huge variation among its federal states. Often, Khartoum State with greater than eight million people is considered food and nutrition insecure. Therefore, the main goal of this paper is to measure and classify the food and nutrition security situation based on the frequency and severity of the coping strategies adopted by the households. Accordingly, stratified random sampling cluster technique was applied to collect the data from 320 households using general structured questionnaire and focus group discussion during 2015. The data analyzed using Coping Strategies Index (CSI) and descriptive statistics technique. The outcomes show 63.1% of the selected households have encountered food deficit due to many reasons. Alternatively, 77.8% of the households have adopted the coping strategies due to lack of money to buy food. Individuals in the selected localities give different severity levels to the coping strategies. The mean values of CSI in Bahari and Umbada localities are 42.61 and 38.82, respectively indicating the higher level of food and nutrition insecurity relative to Khartoum locality (34.56). Generally, 37.2% and 25.6% of the households are classified as less and moderate food and nutrition insecure, respectively. Whereas, 7.5%, 12% and 3.8% of the households in Bahari, Umbada and Khartoum localities are classified as severe food and nutrition insecure. Moreover, food and nutrition insecure/secure levels are statistically significant between the selected localities ($\chi^2$=16.59). The study recommends support access to food by using several policies that recuperate the food and nutrition insecurity. Eventually, monitoring and evaluating CSI is required during different times within the year.**

**Keywords:** food and nutrition, lack of money, coping strategies index (CSI), households, Khartoum State.

## INTRODUCTION

In developing countries in general and in African countries in particular, several factors restrict the achievement of food security and nutrition among the population. These factors are mainly related to the

natural hazards, market risk, uncertainty, political unrest, and governmental policies. Thus, there is a need to reduce the impact of these factors that directly or indirectly lead to poor living conditions of the populace.

Conversely, the food shortage at the household's level can be transitory or permanent, chronic or mild, depending on the determinants and persistence level of the factors that lead to food deficiency. A food-secure household does not mean that all individuals (members) within it are food-secure. The most vulnerable groups in particular may not always get enough food to eat. Moreover, each one of the "three pillars" of the household food security (availability, accessibility and stability) can be shocked by a variety of several diverse risk conditions among these: economic crisis, natural disasters, conflicts and war, and policy changes (Adegbenga, 2009). Therefore, with different situations of food and nutrition insecurity, people have to develop alternative strategies in order to mitigate the effects of vulnerability and risk associated with food insecurity. In consequence, the incidences of food insecurity obligate the vulnerable people to cope with food crises in order to cover their food consumption needs. This involves the principle concept and idea of coping strategies. The coping consumption strategies are set and recognized based on the culture and traditional atmosphere in order to overcome the critical effects of food and nutrition insecurity. Thus, the coping strategies are the means that people use in order to maintain their livelihoods during the stress time such as famine, drought, flood, etc. as argued by Abdelrazig and Ahmed, (2006). Therefore, there are several coping strategies that households adopt when they face the dilemma of food nutrition insecurity. Recently, measuring household food and nutrition insecurity has become costly, difficult, and complex. Accordingly, these coping strategies are used sometimes to measure and assess the situation of food and nutrition insecurity/security among the households.

Generally, the households among different states in Sudan experienced from food deficits and higher poverty rate. This could be one of the reasons that forced the households to adopt some coping strategies in order to secure their food demand needs. Given, the large share spends on food items, the poor households depended greatly on non-agricultural products and/or they adjusted their food consumption pattern. Recently, this situation is aggravated by the economic policies (liberalization policies) that adopted by the government since the last decade. As a consequence, the household is distressed by higher food deficiency due to the low income and higher food prices. Thus, the outcome of the large drop in the income coupled with a rapid rise in food prices had obligated the households to adopt various coping strategies in order to mitigate the food and nutrition insecurity problems. In many regions the households have adjusted their food consumption pattern by cutting the size and frequency of meals as well as changing the composition of their food diets and food habits (Teklu *et al*., 1999; FAO, 2005; USAID, 2006; Elsheikh and Mahmoud, 2010). Such a situation causes widespread diseases, malnutrition, and poor sanitary conditions. Consequently, this situation leads to unavailability of food, inaccessibility to enough food and/or bad quality of food intake. In fact, there are general factors that governed the use of different coping strategies. These are the availability and access to get enough food and availability of job opportunities. In view of that, the households may obligate to adopt the different coping strategies during the time of shortfall in food consumption. This does not indicate that the households could not use these coping strategies or a part of them during the other times within the year. Indeed, the households could adopt some coping strategies whenever they are faced with a problem of food shortages. Accordingly, the objective of this research is to describe the household's food characteristics (i.e food meals and food deficit). Specifically, the research also seeks to assess and classify the food security and nutrition situation based on the use of the coping strategies adopted by the households in order to mitigate the shortfall in food consumption.

## RESEARCH METHODOLOGY

### *Study Area*

Khartoum State is one of the eighteen States of Sudan although; it is the smallest State by area (approximately 22,142 $km^2$). It contains the country's largest cities by population; Omdurman, Al-Khartoum Bahri and Khartoum. The city of Khartoum is the capital of the State as well as the national capital of Sudan. The State lies between longitudes 31.5° to 34° E and latitudes 15° to 16° N. It is surrounded by River Nile State in the north-east, in the north-west by the Northern State, in the east and south east by the States of Kassala, El Gadarif and Gezira, and in the west by North Kordofan (Wikipedia, 2014).

Khartoum State is geographically divided into blocks (or clusters), which are further subdivided into localities. There are a total of three blocks which are divided into localities. The blocks consist of approximately seven localities (Wikipedia, 2014). The census in 2008 estimates the population of Khartoum State to be about 5,274,321inhabitans, which composed of various tribes

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and sub-tribes of the Sudan. The population is 79% urban and 74% of the State's population reported their region of origin to be outside Khartoum (CBS, 2009).

Most of the population works in the government services, the private sector, and banking. There are also a large number of merchants, migrants and displaced people working in the marginal activities. In the countryside most people are engaged in agriculture and grazing and thus; supply the capital, Khartoum, with vegetables, fruits, and dairy products. There are also some residents living on the banks of the rivers engaged in the trades and dependent on the rivers, such as pottery, brick-making and fishing (wikipedia, 2014). About 79% of the population is depending on the agricultural activities in their livelihood system.

*Sampling Technique and Sample Size*

A stratified random sampling cluster technique was applied to select the sample of the about 320 households from blocks, localities, and administrative units in Khartoum State. The three localities namely; Khartoum, Bahri, and Umbada were selected from the three blocks that constitute Khartoum State. Khartoum locality was selected from the first block, Bahri locality was selected from the second block whereas; Umbada locality was selected from the third block as shown in figure 1. Accordingly, the three localities were nominated in order to select about 9 administrative units. In view of that, from Khartoum locality three administrative units were selected particularly; Maiew, Al Kalakla and Dar Elsalam. The administrative units of Elref Elshimali, Elselat and Elgeli were selected from Bahri locality. Additionally, Elameer, El Buga and Elsalam were chosen from Umbada locality. Therefore, about 320 households were selected from these administrative units so as to collect the data that related to the coping consumption strategies.

*Data collection*

The primary data was collected from Khartoum State during the period of April to May, 2015, using general structured household's questionnaire as well as focus group discussion. The questionnaire comprised the following data and information on household's demographic parameters such as age, household's size and education level, data on household's attitudes and behavior, as well as household's food characteristics. Further, the questionnaire contained the lists of the coping consumption strategies that the households adopted it during the shortfall of foods. Moreover, the focus group discussion was conducted with the key informants (male and female headed households) in each of the selected administrate units. The group discussion comprises an average of about 10-12 individuals, and sometimes there is participations from the other households members. The total number of the focus group discussions is about 9 groups, which coincide with the total numbers of the selected administrative units. The data was collected through the focus group discussion helped bring to light different information on the severity of the coping strategies during the shortfall of food consumption. In view of that, the key informants in the administrative unit communities were asked to give rank or degree for each coping strategies that they used based on their opinion and perception.

*Data Analysis*

The data was analyzed using the Coping Strategies Index (CSI). The CSI was developed by CARE and WFP (2003) in order to assess and evaluate the food and nutrition security/insecurity situation based on the use of different coping strategies. The CSI is obviously used to monitor and evaluate the short-term impact of food aid and early warning indicators. The CSI is usually applied as a tool to assess food insecurity in order to assist in targeting food aid to the vulnerable people. Likewise, the CSI helps to estimate the amount of food aid required and is also used as an indicator for longer-term changes in the food security status.

The CSI is developed through a series of questions concerning the use of coping mechanisms when households do not have access to enough food or they have no money to buy foods. This results in a simple numeric score used as a quantitative measurement of food and nutrition security/insecurity. The fundamental idea of the CSI is to combine both frequency and severity of various coping strategies so as to emerge with a quantitative measurement for food and nutrition insecurity/security. The CSI scores denote that the household with a higher value is likely to be more food and nutritionally insecure compared to the household with a lower score value. The monitoring changes in the CSI score during a specific period of time, it can indicate whether the household's food and nutrition security/insecurity status is declining or improving.

*Relative Frequency of the Coping Strategies*

The basic idea behind the relative frequency is to evaluate how many times the household uses each coping strategy. This means asking the household how often they applied each coping strategy in the list. This occurs through asking the respondent households to give a rough indication of the relative frequency of the coping strategies used during specific period of time. Even so, precise recall is often difficult over a long period

**Table 1: Assessing the numerical values to the relative frequency of the coping strategies**

| Score based on the range of each category | Relative frequency categories | | | | |
|---|---|---|---|---|---|
| | Never/ week | Hardly at all <1/week | Once in awhile 1-2/week | Pretty often 3-6/week | Every day |
| | 0 | 0.5 | 1.5 | 4.5 | 7 |

Source: Modified from CARE and WFP, (2003)

of time, but asking about the relative frequency provides adequate information. The recall of the relative frequency are roughly measured based on how many days per week or per month a household had to rely on various coping strategies ranking from "never" to "every day." This represents the simplest means of scoring that is used to obtain a quantitative measurement for the relative frequency. This is executed through taking the mid-point of the range of days in each category and thus assigning it as a value for that category as shown in table 1.

*Categorizing the Severity and Weighing the Coping Strategies*

The use of coping strategies varies among regions and households (Saman, 2007). Different coping strategies have different magnitudes of severity. This denotes that the severity of the coping strategies is divergent and it is based on the opinions and the perceptions of individuals living in specific community. This actually depends on the incidence and severity of food insecurity, which also differ among people at various times. Some coping strategies would be perfectly normal behavior in some places and extreme circumstances in other places. Nevertheless, the severity is measured by ranking each coping strategy adopted by the households. This ranking is made by individuals in the community under the study. The identification of severity is conducted through the focus group discussions. The degree of severity for each coping strategy was collected by asking the individuals to classify the coping strategies that they used based on their opinions (1=less severe, 2=moderate, 3=severe, and 4=very severe). The means of scoring reflect the weight of the severity for each coping strategy that the household adopted.

After the setting the severity ranks for each coping strategy, the consensus ranking should be represented by a whole number in the most frequent response. Thus, the means of scoring underline the severity weight for each coping strategy the household adopted.

Moreover, the descriptive statistical technique using frequency, histogram, mean value and percentages as well as cross tabulation were applied. The mean difference in meal intake was determined using one way analysis of variance (ANVOA table). A two-way table using chi-square test ($\chi^2$) for counting frequency is also applied (Contingency table). Additionally, chi-square ($\chi^2$) was applied to test the significant differences between the selected localities and the relative frequency as well as the severity of the coping consumption strategies. Similarly, the differences between the selected localities and the status of food and nutrition security/insecurity using coping strategies index scores were also tested using chi-square ($\chi^2$).

## RESULTS AND DISCUSSIONS

Characteristics of the Households Food Consumption

*Daily Food Consumption*

Generally, the daily meals consist of breakfast, lunch and dinner. The components of meal are varies from households to another as well as from region to another region. Its also differ among the adults and children within the same households. The way of taking meal is a function of household's behavior and attitudes. Accordingly, table 2 demonstrates the food meal intake by adults and children under-five and the outcomes of ANOVA table. The results reveal that the average numbers of meals intake by adults is about 3 meals. However, there is a high significant differences among the households in the selected localities at level 1% (F-test =6.60**). Conversely, the average numbers of meal intake by children under-five years is about 3 meals in each of Bahari, Umbada and Khartoum localities. Nevertheless, the average numbers of meal intake by children less than five years is not significant among the selected households in the three localities.

Additionally, the households are also interviewed about the meal intake that had been eaten during the day before survey for both adults and children under five years as shown in table 2. The outcome depicts that the numbers of meal intake that had eaten by adults during the day before survey is about 2 meals. The results show the higher significant differences between the

**Table 2: Food meals intake by adults and children under-five years in Khartoum State, 2015**

| Items | Localities | Mean value | F-test value |
|---|---|---|---|
| Average numbers of meal intake by Adults | Bahari | 2.5 (0.5) | 6.60** |
| | Umbada | 2.7 (0.5) | |
| | Khartoum | 2.4 (0.5) | |
| | Total | 2.5 (0.5) | |
| Average numbers of meal intake by children Less than five years | Bahari | 3.4(0.7) | 1.06 |
| | Umbada | 3.4 (0.9) | |
| | Khartoum | 3.3(0.7) | |
| | Total | 3.4(0.8) | |
| Numbers of meal have taken by adults one day before survey | Bahari | 3.0 (0.7) | 3.74** |
| | Umbada | 3.0 (0.6) | |
| | Khartoum | 2.0 (0.5) | |
| | Total | 2.0 (0.6) | |
| Numbers of meal have taken by under-five during the day before survey | Bahari | 3.2(0.9) | 0.15 |
| | Umbada | 3.2 (0.8) | |
| | Khartoum | 3.2(0.8) | |
| | Total | 3.2(0.8) | |

Remarks: Numbers between brackets are the standard deviation – the sample size is equal to 320 households distributed as 106 households in Bahari locality, 108 households in Umbada locality and 106 households in Khartoum locality-** significant at 5% level.

Source: Field survey, 2015

households in the selected localities and the numbers of meal intake by adults at level 5% (F- test=3.74). In contrast, the number of meals intake by children less than five years during the day before survey is about 3 meals conversely; it's insignificantly difference among the households in the selected localities.

*Household's food deficit*

Food deficit is the main characteristics of food insecurity. Food deficit usually occurs due to the lack of accessibility to food or unavailability of money to purchase enough foods. Thus, the critical time of food deficit is varies from households to another and also from region to another region. Generally, 63.1% of the selected households in all localities in Khartoum State mentioned that they encountered by food deficit due to many reasons. Figure 2 shows the distribution of the households in Khartoum State according to the food deficit among the year. It's obviously shown that most of the households are suffering from food shortage in all months among the year. Conversely, the severity of food shortage itself is not same among the months. Therefore; its visibly appear from the figure that 30.6%, 28.8% and 25.3% of the households in Khartoum State reported that the months of June, July and August, respectively are most important months in which they suffering from food shortage.

On the other hand, the behavior of using the coping strategies is based mainly on asking the households a series of questions concerning the use of coping mechanisms that they applied when they do not have access to enough food or when they have no money to buy food. Based on this, figure 3 presents the distribution of the households in Khartoum State according their attitudes to insufficient foods or lack of money to buy food during the time of using the coping strategies. The results disclose that about 48.1% of the households mentioned that they used the coping strategies due to in sufficient food. Alternatively, 77.8% of the households in Khartoum State are applied the coping strategies due to the lack of money to buy food.

Households Coping strategies

*Severity of the Coping Strategies*

The individuals in each of the selected localities set a degree for each coping strategy that they used based on the severity of that strategy. This was conducted based on focus group discussions with key informants in the administrative unit communities (both female and male

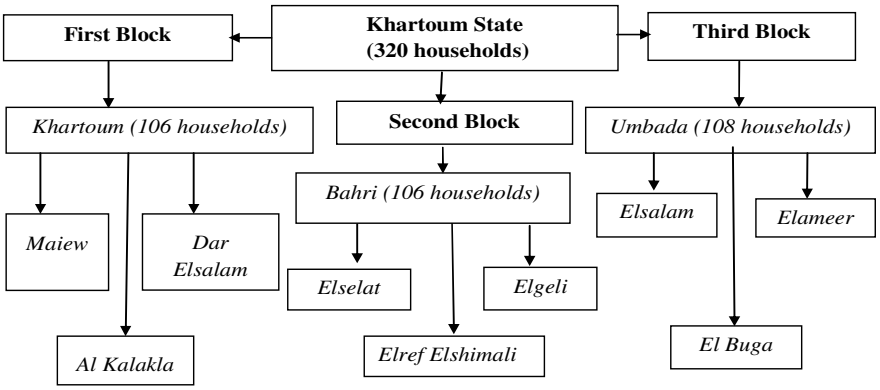


**Figure 1: Stratified random sampling cluster technique and sample size of the selected households in Khartoum State, 2015**
Source: Field Survey, 2015

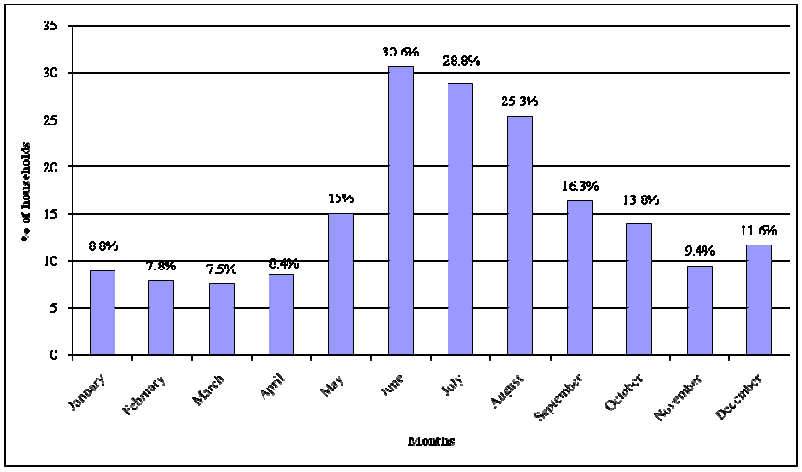


**Figure 2: Distribution of the households in Khartoum State according to the food deficit among the year, 2015**
Remark: Sample size 320 households
Sources: field survey, 2015

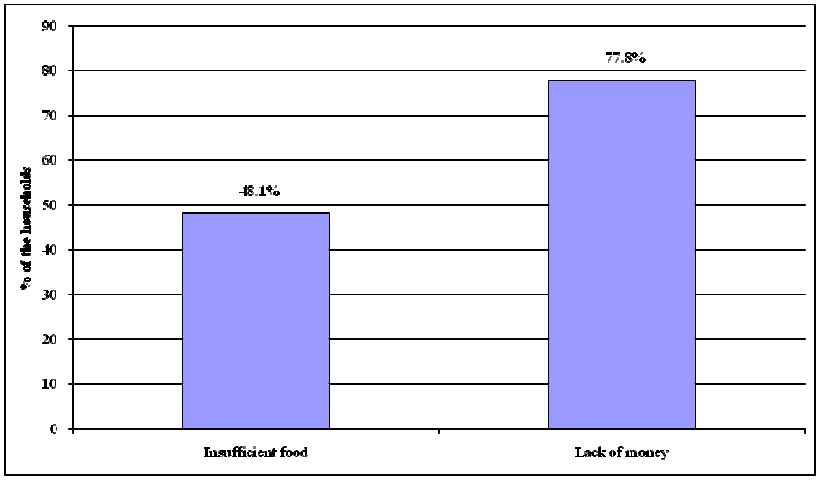


**Figure 3: Distribution of the household's according to insufficient foods and lack of money in Khartoum State, 2015**
Remark: sample size 320 households
Sources: field survey, 2015

**Table 3: Average severity weights for various coping strategies among the selected localities in the Khartoum State, 2015**

| List of Coping Strategies | Umbada (F.G=3) | Khartoum (F.G=3) | Bahari (F.G=3) | Total (F.G=9) |
|---|---|---|---|---|
| Rely on less preferred and expensive foods | 1 | 1 | 1 | 1 |
| Barrow food from friends or relatives | 1 | 1 | 1 | 1 |
| Purchase food on credit | 2 | 1 | 1 | 1 |
| Changing food pattern for households members | 1 | 1 | 1 | 1 |
| Send households members to eat elsewhere | 3 | 4 | 3 | 3 |
| Skip entire days without eating | 3 | 4 | 4 | 4 |
| Skip one meal per day | 1 | 1 | 1 | 1 |
| Rely on help from relatives and friends to secure food | 1 | 2 | 3 | 2 |
| Cooking food only once a week in order to reduce the fuel used and time spent (freeing up time for earning an income); | 3 | 1 | 3 | 2 |
| Selling households assets to purchase foods | 2 | 2 | 2 | 2 |
| Rely on foods that kept without special storage | 3 | 1 | 3 | 2 |
| purchasing cheaper staples to replace costlier and more nutritious items | 1 | 1 | 1 | 1 |
| Reduce the consumption for adult in order to feed children | 1 | 1 | 1 | 1 |

Remark: the numbers of group discussion are about 9 groups - Severity categories are; 1= less severe, 2=moderate severe 3=severe, and 4=higher severe

Source: Field survey, 2015

groups). The total number of focus groups was about 9 interviews, which coincide with the total number of selected administrative units. The average severity weight is calculated by multiplying the average degree of severity for each coping strategy adopted by the consensus ranking of the same coping strategy. Table 3 shows the outcome of the average severity weight. It perceptibly appears from the table that the individuals in the three localities gave low and similar severity weight to "relying on less preferred and less expensive food," "barrow food from friends or relatives," "purchasing food on credit," and "changing food pattern for the households members," "skip one meal per day," "purchasing cheaper staples to replace costlier and more nutritious items," and "reduce the consumption for adult in order to feed children." The explanation for this is that the application of these strategies so as to mitigate the effects of not having enough food seems to be a normal behavior nearly in all localities. Concerning the coping strategies of "skip entire days without eating," and "send households members to eat elsewhere," most of the people in Sudan applied these coping strategies to reduce the costs incurred from supporting the full meals or feeding all household members. However, the results show that the households in the selected localities gave high severity weight for both coping strategies. These represent the difficulties in applying these coping strategies for the households in these localities. Furthermore, the individuals in the selected localities also gave a moderate degree of severity to the coping strategy of "selling households assets to purchase foods." The explanation for this is that the household's assets denote an important source of income and wealth so they can sell them when they need to secure their food. On the other hand, high severity weights are also given to the coping strategies of "cooking food only once a week in order to reduce the fuel used and time spent" and "rely on foods that kept without special storage." This mainly because the major traditional behavior of the Sudanese people is to cook and prepare foods every day regardless of the additional costs that incurred according to this behavior.

Additionally, table 4 illustrates the distribution of the households according to the degree of severity for the various coping strategies adopted in the Khartoum State. The table also reflects the statistical test of chi-square. The outcomes depicts that all households in both Bahri and Khartoum localities as well as 65.7% of the households in Umbada locality give less severe degree to the coping strategy of "purchase food on credit". About 43.3% of the households in Umbada locality present severe degree to the coping strategy of "purchase food

**Table 4: Degree of severity for the various coping strategies adopted by households and Chi-Square test in Khartoum State, 2015**

| List of Coping Strategies/ localities | Degree of Severity | | | | Chi-square value |
|---|---|---|---|---|---|
| | Less Severe | Moderate severe | Severe | Higher severe | |
| Purchase food on credit | | | | | 82.13*** |
| *Bahari* | 100 | | | | |
| *Umbada* | 65.7 | | 34.3 | | |
| *Khartoum* | 100 | | | | |
| Send HH members to eat elsewhere | | | | | 44.39*** |
| Bahari | 33.0 | | | 67.0 | |
| Umbada | 32.4 | | | 67.6 | |
| Khartoum | | | | 100 | |
| Skip entire days without eating | | | | | 155.60*** |
| *Bahari* | | | | 100 | |
| *Umbada* | | 34.3 | | 65.7 | |
| *Khartoum* | | | 34.0 | 66.0 | |
| Skip one meal per day | | | | | 46.85*** |
| *Bahari* | 66.0 | 34.0 | | | |
| *Umbada* | 65.7 | 34.3 | | | |
| *Khartoum* | 100 | | | | |
| Rely on help from relatives and friends to secure food | | | | | 178.46*** |
| *Bahari* | | 33.0 | | 67.0 | |
| *Umbada* | 66.7 | 33.3 | | | |
| *Khartoum* | 67.0 | | | 33.0 | |
| Cooking food only once per week | | | | | 213.21*** |
| *Bahari* | | 34.0 | | 66.0 | |
| *Umbada* | | 34.3 | | 65.7 | |
| *Khartoum* | 67.0 | 33.0 | | 0 | |
| Selling HH assets to purchase foods | | | | | 195.41*** |
| *Bahari* | 34.0 | 66.0 | | | |
| *Umbada* | 65.7 | | | 34.3 | |
| *Khartoum* | 67.0 | | | 33.0 | |
| Rely on foods that kept without special storage | | | | | 267.30*** |
| *Bahari* | | 33.0 | | 67.0 | |
| *Umbada* | 32.4 | | | 67.6 | |
| *Khartoum* | 100 | | | | |
| Reduce the consumption for adult in order to feed children | | | | | 46.07*** |
| *Bahari* | 67.0 | 33.0 | | | |
| *Umbada* | 65.7 | 34.3 | | | |
| *Khartoum* | 100 | | | | |

Remarks: F.G. = the number of focus group discussions. The sample size is equal to 320 households distributed as 106 households in Bahari locality, 108 households in Umbada locality and 106 households in Khartoum locality- Severity categories are; 1= less severe, 2=moderate severe 3=severe, and 4=higher severe *** Significant at level1%

Source: Field survey, 2015

on credit." The two way table shows the higher significant differences between severity degrees of the coping strategy and localities at level 1% (Chi-square value= 82.13). Similarly, about 33% and 32.4% of the households in Bahari and Umbada localities give less severe degree to the coping strategy of "send household's members to eat elsewhere". Even as, all households in Khartoum locality as well as 67% and 67.6% of the households in Bahari and Umbada localities, respectively give higher severe degree to the coping strategy of "send households members to eat elsewhere." The result also shows the higher significant differences between severity degrees of this coping strategy and localities at level 1% (Chi-square= 44.39).

The table also depicts that 34.3% and 34% of the households in Umbada and Khartoum localities present moderate and severe degrees, respectively to the coping strategy of "skip entire days without eating". Whereas, the whole households in Bahari, about 65.7% and 66% of the households in Umbada and Khartoum localities give higher severe degree to the coping strategy of "skip entire days without eating." Additionally, the test statistical of chi-square (155.60) reveals the higher significant differences between severity degrees of this coping strategy and localities at level 1%. Similarly, the outcome also illustrates that all selected households in Khartoum locality and 66% and 65.7% of the households in Bahari and Umbada localities give less severe to the coping strategy of "skip one meal per day". Likewise, 34% and 34.3% of the households in both Bahari and Umbada localities, respectively provide moderate severe degree to the coping strategy of "skip one meal per day". The statistical test reflects the higher significant differences between severity degrees of the coping strategy and localities at level1% (Chi-square= 46.85).

Nearly, 66.7% and 67% of the households in both Umbada and Khartoum localities, correspondingly give less severe to the coping strategy of "rely on help from relatives and friends to secure food". Whereas, 33% and 33.3% of the households in Bahari and Umbada localities present moderate severe degree to the coping strategy of "rely on help from relatives and friends to secure food." On the other hand, 67% and 33% of the households in both Bahari and Khartoum localities, correspondingly give high severe degree to the coping strategy of "rely on help from relatives and friends to secure food". The chi-square test is about 178.46, which reflects the higher significant differences between severity degrees of the coping strategy and localities at level 1%.

Approximately, 67% of the households in Khartoum locality give less severe to the coping strategy of "cooking food only once per week". Only, 34%, 34.3% and 33% of the households in Bahari, Umbada and Khartoum localities, respectively present moderate severe degree to the coping strategy of "cooking food only once per week." Alternatively, 66% and 65.7% of households in both Bahari and Umbada localities provide higher severe degree to the coping strategy of "cooking food only once per week." The two way table reflects the higher significant differences between the severity degrees of the coping strategy and localities at level1% (Chi-square= 213.21).

Approximately, 34%, 65.7% and 67% of the households in Bahari, Umbada and Khartoum localities give less severe to the coping strategy of "selling households assets to purchase foods". Only, about 66% households in Bahari locality give moderate severe degree to the coping strategy of "selling households assets to purchase foods." About, 34.3% and 33% of the households in both Umbada and Khartoum localities, respectively give higher severity degree to the coping strategy of "selling households assets to purchase foods." The test statistical of chi-square value is equal to 195.41, which shows the higher significant differences between severity degrees of the coping strategy and localities at level 1%.

On the other hand, all households in Khartoum locality and 32.4% of the households in Umbada locality give less severe to the coping strategy of "rely on foods that kept without special storage". About 33% households in Bahari locality give moderate severe degree to the coping strategy of "rely on foods that kept without special storage." Additionally, 67% and 67.6% of the households in both Bahari and Umbada localities, respectively present higher severe degree to the coping strategy of "rely on foods that kept without special storage." The chi-square is equal to 267.30, depicts the higher significant differences between severity degrees of the coping strategy and localities at level1%.

Moreover, all household in Khartoum locality in addition to 67% and 65.7% of the households in Bahari and Umbada localities provide less severe to the coping strategy of "reduce the consumption for adult in order to feed children". While, 33% and 34.3% of the households in Bahari and Umbada localities give moderate severe degree to the coping strategy of "reduce the consumption for adult in order to feed children." Therefore, the test statistical of chi-square is about 46.07 which describe the higher significant differences between severity degrees of the coping strategy and localities at level 1%.

Generally, the degree of severity for the other coping strategies such as "rely on less preferred and expensive foods," "barrow foods from friends or relatives," "changing food pattern for the households members", as well as "purchasing cheaper staples to replace costlier and more nutritious items" are insignificantly differences with selected localities in Khartoum State.

**Table 5: Relative frequency of the coping strategies adopted by the households in Bahari locality, 2015**

| List of Coping Strategies | Never | Hardly at all <1/ week | Once in a while 1-2/ week | Pretty often 3-6/week | Every day |
|---|---|---|---|---|---|
| Rely on less preferred and expensive foods | 11 | 4 | 17 | 49 | 25 |
| Barrow food from friends or relatives | 36 | 17 | 25 | 27 | 1 |
| Purchase food on credit | 18 | 8 | 15 | 48 | 17 |
| Changing food pattern for households members | 6 | 2 | 21 | 54 | 23 |
| Send HH members to eat elsewhere | 67 | 14 | 10 | 10 | 5 |
| Skip entire days without eating | 76 | 13 | 7 | 10 | 0 |
| Skip one meal per day | 42 | 8 | 17 | 32 | 7 |
| Rely on help from relatives and friends to secure food | 50 | 15 | 23 | 18 | 0 |
| Cooking food only once a week in order to reduce the fuel used and time spent (freeing up time for earning an income); | 53 | 7 | 17 | 22 | 7 |
| Selling households assets to purchase foods | 64 | 11 | 19 | 12 | 0 |
| Rely on foods that kept without special storage | 51 | 17 | 14 | 22 | 2 |
| purchasing cheaper staples to replace costlier and more nutritious items | 27 | 4 | 10 | 44 | 21 |
| Reduce the consumption for adult in order to feed children | 27 | 15 | 19 | 36 | 9 |

Remark: the sample size is equal to106 households in Bahari locality
Source: field survey, 2015

*Relative Frequency of the coping strategies*

The households in Khartoum State use all the coping strategies in the list, or at least part of them, in order to fulfill their food demand needs. The use of these coping strategies depends on income diversification and availability of other resources at the household's level. On the other hand, the application of these coping strategies differs among the households themselves. For this reason, each household was asked to recall their coping strategies that they used. The relative frequency of using different coping strategies was ranked from "never" to "every day." Likewise, the relative frequency of coping strategies may explain the discrepancy in the application of the same coping strategies from locality to another. Consequently, the relative frequency of the coping strategies for each of the selected localities is discussed below.

Table 5 presents the relative frequency of the coping strategies adopted by the households in Bahari locality. It clearly emerges from the table that the majority of the households depend on "less preferred and expensive foods", "purchasing food on credit" and "changing food pattern for household's members." The application of these coping strategies ranks from "once in while 1-2/week" to "every day". On the other hand, the relative frequency for the coping strategy "borrowing food from friends or relative" ranks from "never" to "pretty often 3-6/week". Thus, application of this coping strategy justifies better living conditions for the households since they do not apply every day in this locality.

More than half of the households in Bahari locality also cited that coping strategies "send household's members to eat elsewhere," "skip entire days without eating," "selling households assets to purchase foods," and "cooking food only once a week," are "never" adopted. This indicates the difficulties in applying these coping strategies for them. Alternatively, the coping strategies of "skip one meal per day," "rely on help from relatives and friends to secure food" and "rely on foods that kept without special storage" rank from "never" to "once in a while 1-2/week". Otherwise, the coping strategies "purchasing cheaper staples to replace costlier and more nutritious items" as well as "reduce the consumption for adult in order to feed children" rank from "once in a while 1-2/ week" to "every day".

Table 6 demonstrates the relative frequency of the coping strategies use by the households in Umbada

**Table 6: Relative frequency of the coping strategies used by households in Umbada locality, 2015**

| List of Coping Strategies | Never | Hardly at all <1/ week | Once in a while 1-2/ week | Pretty often 3-6/week | Every day |
|---|---|---|---|---|---|
| Rely on less preferred and expensive foods | 34 | 2 | 14 | 34 | 24 |
| Barrow food from friends or relatives | 56 | 7 | 16 | 29 | 0 |
| Purchase food on credit | 50 | 5 | 11 | 39 | 3 |
| Changing food pattern for households members | 3 | 3 | 13 | 43 | 22 |
| Send HH members to eat elsewhere | 79 | 6 | 13 | 5 | 5 |
| Skip entire days without eating | 80 | 4 | 7 | 17 | 0 |
| Skip one meal per day | 46 | 3 | 8 | 42 | 9 |
| Rely on help from relatives and friends to secure food | 67 | 8 | 17 | 15 | 1 |
| Cooking food only once a week in order to reduce the fuel used and time spent (freeing up time for earning an income); | 82 | 2 | 2 | 19 | 3 |
| Selling households assets to purchase foods | 72 | 7 | 13 | 16 | 0 |
| Rely on foods that kept without special storage | 39 | 20 | 20 | 21 | 8 |
| purchasing cheaper staples to replace costlier and more nutritious items | 38 | 6 | 11 | 29 | 24 |
| Reduce the consumption for adult in order to feed children | 43 | 3 | 4 | 36 | 22 |

Remark: Sample is equal108 households in Umbada locality
Source: Field survey, 2015

locality. It obviously appears from the table that the most of the households depend on “less preferred and less expensive foods” from “once in a while 1-2/week” to “every day”. The households in Umbada locality ranks their use of the coping strategies “borrowing food from friends or relative” “purchasing food on credit” and “skip one meal per day” from “never” to “pretty often 3-6/week”. The coping strategy “changing food pattern for household's members” adapts from “pretty often 3-6/week” to “every day”. This means that it's an important strategies for them as the same as the households in Bahari locality.

More than half of the households in Umbada locality mentioned that coping strategies “send household's members to eat elsewhere,” “skip entire days without eating,” “selling households assets to purchase foods,” “rely on help from relatives and friends to secure food,” “cooking food only once a week” and “selling households assets to purchase foods” are “never” adopted. This indicates the difficulties in applying these coping strategies. Additionally, the coping strategies of “skip one meal per day,” “rely on foods that kept without special storage,” “purchasing cheaper staples to replace costlier and more nutritious items” as well as “reduce the consumption for adult in order to feed children” rank from “never” to “pretty often 3-6/week”.

Table 7 reveals the relative frequency of the coping strategies in Khartoum locality. It visibly emerges from the table that the households in Khartoum locality depend on “less preferred and less expensive foods” from “pretty often 3-6/week” to “every day”. The households in Khartoum locality rank their use of the coping strategies “borrowing food from friends or relative,” “purchase food on credit,” “changing food pattern for household's members” and “skip one meal per day” from “never” to “pretty often 3-6/week”.

A greater part of the households in Khartoum locality points out that coping strategies “send household's members to eat elsewhere,” “skip entire days without eating,” “selling households assets to purchase foods”, “rely on help from relatives and friends to secure food” and “cooking food only once a week” are “never” adopted. This indicates the difficulties in applying these coping strategies as similar to Umbada locality. Also, the coping strategies of “rely on foods that kept without special storage,” “purchasing cheaper staples to replace costlier and more nutritious items” as well as “reduce the consumption for adult in order to feed children” rank from

**Table 7: Relative frequency of the coping strategies used by households in Khartoum locality, 2015**

| List of coping Strategies | Never | Hardly at all <1/ week | Once in a while 1-2/ week | Pretty often 3-6/week | Every day |
|---|---|---|---|---|---|
| Rely on less preferred and expensive foods | 25 | 6 | 7 | 34 | 34 |
| Barrow food from friends or relatives | 49 | 8 | 29 | 20 | 0 |
| Purchase food on credit | 38 | 4 | 12 | 45 | 7 |
| Changing food pattern for households members | 27 | 5 | 14 | 42 | 18 |
| Send HH members to eat elsewhere | 76 | 2 | 17 | 11 | 0 |
| Skip entire days without eating | 70 | 10 | 8 | 17 | 1 |
| Skip one meal per day | 41 | 5 | 16 | 37 | 7 |
| Rely on help from relatives and friends to secure food | 59 | 6 | 28 | 12 | 1 |
| Cooking food only once a week in order to reduce the fuel used and time spent (freeing up time for earning an income); | 58 | 7 | 10 | 21 | 10 |
| Selling households assets to purchase foods | 71 | 6 | 10 | 17 | 2 |
| Rely on foods that kept without special storage | 33 | 11 | 21 | 37 | 4 |
| purchasing cheaper staples to replace costlier and more nutritious items | 33 | 4 | 8 | 42 | 19 |
| Reduce the consumption for adult in order to feed children | 23 | 4 | 14 | 38 | 27 |

Remark: the sample is equal106 households in Khartoum locality

"never" to "pretty often 3-6/week" as similar to the households in Umbada locality.

Table 8 shows the relative frequency of the various coping strategies adopted in Khartoum State and the test statistical of chi-square. It clearly emerges from the table that the more than half of the households are intensively depend on "rely on less preferred and expensive foods" from "once a while 1-2/ week" to "every day". The application of this coping strategy is significantly difference at level 5% among the households in the selected localities in Khartoum State (chi-square value =23.70). The coping strategies "borrowing food from a friend or relative" and "rely on foods that kept without special storage" are adopted from "never" to "pretty often 3-6/week". Both coping strategies are significantly differences at level 10% with chi-square values of 17.61 and 18.31, respectively

The coping strategy "purchasing food on credit" mostly ranks from "never" to "pretty often 3-6/week". The coping strategies of "purchasing food on credit" are significantly difference between the households in the selected localities at level 1% with a value of chi-square equal to 29.47

Moreover, the households in Khartoum State are adopted the coping strategy of "changing food pattern for households members" from "once in a while 1-2/week" to "every day" however; the application of this coping strategy is significantly difference at level 5% among the households in Khartoum State (chi-square equal to 21.10). A greater part of the households in Khartoum State "never" adopt the coping strategy "send households members to eat elsewhere". The application of this coping strategy by the households regard as a source of shame. Nevertheless, this coping strategy is significantly difference at level 5% among the households with chi-square equal to 20.52. Correspondingly, Abdalla, (2012) argued that the coping strategies of "sending household members to eat

**Table 8: The relative frequency and test of Chi-square for the coping strategies used by the households in Khartoum State, 2015**

| List of coping Strategies | Never | Hardly at all <1/ week | Once in a while 1-2/ week | Pretty often 3-6/week | Every day | Chi-square Test |
|---|---|---|---|---|---|---|
| Rely on less preferred and expensive foods | 70 | 12 | 38 | 117 | 83 | 23.70** |
| Barrow food from friends or relatives | 141 | 32 | 70 | 76 | 1 | 17.61* |
| Purchase food on credit | 106 | 17 | 38 | 132 | 27 | 29.47*** |
| Changing food pattern for households members | 30 | 10 | 48 | 139 | 63 | 21.10** |
| Send HH members to eat elsewhere | 222 | 22 | 40 | 26 | 10 | 20.52** |
| Skip entire days without eating | 226 | 27 | 22 | 44 | 1 | 9.62 |
| Skip one meal per day | 129 | 16 | 41 | 111 | 23 | 7.902 |
| Rely on help from relatives and friends to secure food | 176 | 29 | 68 | 45 | 2 | 11.957 |
| Cooking food only once a week in order to reduce the fuel used and time spent (freeing up time for earning an income) | 193 | 16 | 29 | 62 | 20 | 20.04** |
| Selling households assets to purchase foods | 207 | 24 | 42 | 45 | 2 | 10.254 |
| Rely on foods that kept without special storage | 123 | 48 | 55 | 80 | 14 | 18.31* |
| purchasing cheaper staples to replace costlier and more nutritious items | 98 | 14 | 29 | 115 | 64 | 6.910 |
| Reduce the consumption for adult in order to feed children | 92 | 22 | 37 | 110 | 58 | 38.14*** |

Remarks: sample size= 320 households- *, **, and *** significant at 10%, 5% and 1% respectively.

elsewhere" and "asking for help or begging" are the most severe coping strategies even in the time of food deficit and the households regard them as a source of shame in the dry land sector of Sudan.

The coping strategies of "skip entire days without eating," "skip one meal per day," "rely on help from relatives and friends to secure food" and "selling households assets to purchase foods," "purchasing cheaper staples to replace costlier and more nutritious items" apply from "never" to "pretty often 3-6/week". The outcomes show that these coping strategies are insignificant among the households in the selected localities of Khartoum State. Moreover, the coping strategy "cooking food only once a week" applies from "never" to "pretty often 3-6/week". The result shows the coping strategy of "cooking food only once a week" is significantly difference among the households in Khartoum State at level 5% (chi-square=20.04). Further, the coping strategy "reduce the consumption for adult in order to feed children" adopts from "once a while 1-2/week" to "every day". The coping strategy reveals the high significant difference among the households in Khartoum State at level 1% with chi-square of about 38.14. Relevant study in the dry land sector of Sudan revealed that the relative frequency of adopting the coping strategy "reducing the number of meals eaten per day" increases from "once in a while 1-2/week" to every day" as discussed by Abdalla, (2015). She also found that the coping strategies such as decrease the amount of food consumed or reducing the number of meals or skipping the entire day without meals are mostly used during the rainy season compared to the dry season. Related results were also obtained by Adegbenga (2009), USAID (2010) and Jenny and Egal (2002). They also considered the reduction in the amount of food diet and changes in the composition of meals as adaptive

**Table 9: coping strategies score (CSI) among the selected localities of Khartoum State, 2015**

| Localities | Mean values | Standard deviations |
|---|---|---|
| Bahari | 42.61 | 24.07 |
| Umbada | 38.82 | 33.62 |
| Khartoum | 34.56 | 26.01 |
| Total | 38.67 | 28.34 |

Remarks: The sample size is equal to 320 households distributed as 106 households in Bahari locality, 108 households in Umbada locality and 106 households in Khartoum locality.
Source: Field survey, 2015

measures to deal with food shortages. Besides this, the use of other coping strategies includes the consumption of unconventional foods, reliance on help from relatives or friends, reducing the quantity served to children, and purchasing food on credit.

In contrast, a similar study on coping strategies conducted by Elsheikh and Mohmoud (2010) expressed the importance of traditional practices to reduce food insecurity during food deficit times. These traditional practices are: reducing the number of meals, changing food habits, accessing informal loans, and relying on relief or other kinds of donations. They also identified the adaptation of traditional food strategies as coping strategies rather than adaptive mechanisms or survival strategies. On the other hand, the strategies to decrease the number of people needing to be fed such as “asking for help or begging” and “sending household members to eat elsewhere” are considered to be harsh coping strategies in both dry and rainy seasons. These are predominantly severe coping strategies, and they are a source of shame in Sudan. This outcome disagrees with the finding from the study of Jenny and Egal (2002). They argued the possibility of conducting different severe coping strategies during time of food deficit for the mountain people in Nepal. Generally, ANA (2006), discussed the most frequently used coping strategies in North Kordofan State ranked as follows: eat fewer meals per day, purchase on credit, borrow food from family or friends, eat less preferred foods, migrate for work, work for food only, skip an entire day without food, slaughter livestock, ask for help (beg), and collect wild food

*Coping Strategies Index Score*

The relative frequency and severity weight together are used to obtain a quantitative measurement of food and nutrition insecurity/security for the households in Khartoum State. This quantitative measurement is known as the coping strategies index (CSI) score. The score justify that the households with high value of the score is more food and nutritionally insecure compare to the household with low value. In view of that, the level of the CSI scores for the selected localities is depicted in table 9. It appears from the table the averages of the coping strategies index score (CSI) for Bahari, Umbada and Khartoum localities are about 42.61, 38.82 and 34.56, correspondingly. The CSI score is higher in Bahari locality follow by Umbada and Khartoum localities. Thus, the higher food and nutritionally insecure in Bahari locality may also justify by higher food expenditure. The large variation in the CSI scores among localities is related to differences in food and nutrition security/insecurity situation.

Moreover, based on the coping strategies index score the level of the household's food and nutrition security/ insecurity is classify into four categories. Dolly, (2009) classified the households into four groups based on the CSI score. Those are the households with no coping strategies, the households with a low CSI score (7-19), households with a medium CSI score (20-30), and households with high index CSI score above 30. Similarly, the households is divided into four groups as follow (0-20) represent as food and nutrition secure, (21-50) is less food and nutrition insecure, (51-80) is moderate food and nutrition insecure as well as (>80) severe food and nutrition insecure based on coping strategies index score (CSI). The status of food and nutrition security/ insecurity in Khartoum State presents in table 10. It’s observe from the table that about 29.4% of the total households is food secure. Generally, 37.2% and 25.6% of the households are classified as less and moderate food and nutrition insecure, respectively. About 18.9%, 36.1% and 33% of the households in Bahari, Umbada and Khartoum localities are classify as food and nutrition secure. Nevertheless, about 41.5%, 28.7% and 41.5% of the households in Bahari, Umbada and Khartoum localities classify as less food and nutrition insecure. Conversely, 32.1%, 23.1% and 21.7% of the households in Bahari, Umbada and Khartoum localities classify as moderate food and nutrition insecure. Whereas, 7.5%, 12% and 3.8% of the households in Bahari, Umbada and Khartoum localities

**Table 10: Classification of the households in the selected localities based on coping strategies index score and status of household's food and nutrition secure/insecure in Khartoum State, 2015**

| Food security/ insecurity level | Categories of CSI | Localities (%) | | | Total | Chi-Square Test |
|---|---|---|---|---|---|---|
| | | Bahari (n=106) | Umbada (n=108) | Khartoum (n=106) | | |
| Food and nutrition secure | 0-20 | 18.9 | 36.1 | 33 | 94 (29.4) | 16.59* |
| Less food and nutrition Insecure | 21-50 | 41.5 | 28.7 | 41.5 | 119 (37.2) | |
| Moderate Food and nutrition insecure | 51-80 | 32.1 | 23.1 | 21.7 | 82 (25.6) | |
| Severe food and nutrition insecure | >80 | 7.5 | 12.0 | 3.8 | 25 (7.8) | |
| Total | | 100 | 100 | 100 | 320 (100) | |

Remarks: total sample size= 320 households- Number between brackets are the percentages- chi-square test is significant at level 10%
Source: Field survey, 2015

are classify as severe food and nutrition insecure. Moreover, a few percentages of the households in Khartoum State classify as severe food and nutrition insecure (7.8%). The test statistic value of chi-square shows the significant difference between the food and nutrition insecure/secure levels and the households in the selected localities at level 10% (16.59). Similar study found the insignificant difference between CSI and selected localities in North Kordofan State (Abdalla, 2012).

## CONCLUSION AND RECOMMENDATIONS

The objectives of this report are focused on identifying household's food characteristics and analyzing different coping strategies adopted by households in Khartoum State. The relative frequency and the severity of using these coping strategies are also depicted in this report. The results of the coping strategies index score are used to classify the households into different levels or status of food and nutrition secure/ insecure.

The finding reveals the average daily meal is about 3 meals per day. The meal intake for adults is significant difference among the households in the selected localities. In contrast, the average day meal for under-five year is insignificant. The households are encountered by food deficit particularly in the months of June, July and August. Inaccessibility to food due to the lack of money as well as insufficient food are the main factors that resulted into food deficit. Therefore, the households are forced to apply some coping mechanisms in order to mitigate the food shortage. The outcome showed that individuals in the selected localities gave a higher degree of severity for the coping strategies “skip entire days without eating,” and “sending household members to eat elsewhere,” seeing these strategies as a source of shame.

As well, the relative frequency for using different coping mechanisms showed that the households in Khartoum State increased their application for these coping strategies “barrow food from friends or relatives,” “purchase food on credit,” “changing food pattern for households members,” “skip one meal per day,” “purchasing cheaper staples to replace costlier and more nutritious items,” “reduce the consumption for adult in order to feed children” from “never” to “pretty often3-6/week at all/<1/week”. However, more than half of the households respondents in Khartoum State are never adopted the coping strategies “send households members to eat elsewhere,” “skip entire days without eating”, “rely on help from relatives and friends to secure food,” “cooking food only once a week,” “selling households assets to purchase foods.” The test statistical of chi-square showed the significant differences between the relative frequencies of some coping strategies such as “rely on less preferred and expensive foods,” “barrow food from friends or relatives,” “purchase food on credit,” “changing food pattern for households members,” “send households members to eat elsewhere,” “cooking food only once a week,” “rely on foods that kept without special storage,” and “reduce the consumption for adult in order to feed children.” and the households in the selected localities in Khartoum State.

Furthermore, the combination of both severity and relative frequency reflect the CSI score index, which is used as a measurement of food and nutrition

insecure/secure. The household having the higher value of the score is likely to be more food and nutrition insecure than the household having a lower score. The CSI scores were categorized in two major groups'; food and nutrition secure group and food and nutrition insecure group. The CSI revealed that the households were suffering from different levels of food and nutrition insecure these mostly are; less food and nutrition insecure, moderate food and nutrition insecure and severe food and nutrition insecure. The results reveal the significant differences between the levels of food and nutrition insecure/ secure and the households in the selected localities in Bahari, Umbada and Khartoum. Thus, the challenge is to recognize the dominant group of food and nutrition insecure households in order to assist the access to food. This should be conducting before the implementation the final decision of intervention. This also requires additional attention in order to find a clear understanding for food and nutrition insecure problems in the study area. Also, understanding the characteristics of the most effective groups would help the final solution. The paper proposes several policy implications to recuperate the food and nutrition insecurity among households. Boost the household income is very important issue to reduce the food and nutrition insecurity. Initiate a periodic program is essentially needed for monitoring and evaluating the food and nutrition insecurity situation during different times within the year. Furthermore, identify the critical time in which the households have faced by food consumption deficit. This is essentially important to support the food consumption through successful policy mechanisms that give attention to the availability and accessibility to foods.

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