

**INEQUALITY OF OPPORTUNITIES IN FOOD SECURITY  
AMONG EGYPTIAN HOUSEHOLDS, 2011**

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### ABSTRACT

This study measures the inequality of opportunities in food security among Egyptian households using Human Opportunity Index (HOI). Food security is measured, in terms of food accessibility based on quantity and quality bases. Access to food quantity is measured by poverty status and access to food quality is based on Food Consumption Score (FCS). The study depends on data from Egypt - Household Income, Expenditure, and Consumption Survey (HIECS), 2010/2011. The study aims to examine to what extent the urban-rural gaps of opportunities could be referred to the differences in coverage or differences in the circumstances of individuals. Furthermore, the study examined the main determinants of food accessibility. The HOIs results show that urban areas offer better food opportunities for households than rural areas. This better situation of human opportunities in urban areas is mainly due to the gap in food accessibility based on quantity bases more than that based on quality bases. Decomposition of differences in HOIs among areas shows that the main difference in overall food accessibility between areas is returned to household's accessibility to adequate quantity and food diversity and not to the households' circumstances.

**Keywords:** Human Opportunity Index, Inequality of Opportunities, Food accessibility, Poverty Status, Food Consumption Score.

### عدم المساواة في فرص الحصول على الأمن الغذائي بين الأسر المصرية، ٢٠١١

#### مستخلص الدراسة

تهدف الدراسة الحالية الى قياس عدم المساواة في فرص الحصول على الأمن الغذائي بين الأسر المصرية باستخدام دليل الفرص البشرية (HOI). يتم قياس الأمن الغذائي من خلال سهولة وصول الأسر لكمية كافية ومتنوعة من الغذاء. يتم قياس سهولة الوصول إلى كمية كافية من الغذاء عن طريق مستوى الفقر للأسرة، ويتم قياس سهولة الحصول على كمية متنوعة من الغذاء عن طريق دليل استهلاك الغذاء (FCS). اعتمدت الدراسة على بيانات مسح دخل وإنفاق واستهلاك الأسرة 2010/2011. تهدف الدراسة أيضاً إلى اختبار ما إذا كانت الفجوات في فرص الحصول على الأمن الغذائي بين الحضر والريف ترجع إلى الاختلاف في التغطية أم الاختلاف في خصائص الأفراد أنفسهم. تقوم الدراسة أيضاً باختبار أهم محددات سهولة الوصول إلى الأمن الغذائي.

تشير نتائج دليل الفرص البشرية أن المناطق الحضرية تقدم فرص الحصول على الأمن الغذائي أفضل من المناطق الريفية، ويرجع ذلك أساساً إلى الاختلاف بين الحضر والريف في سهولة الوصول لكمية كافية من الغذاء أكثر من سهولة الوصول إلى كمية متنوعة من الغذاء. ويوضح تقسيم الفجوة في دليل فرص الحصول على الأمن الغذائي بين الحضر والريف إلى أن وجود هذه الفجوة يرجع بالأساس إلى وجود فجوة بين المنطقتين في وصول الأسر إلى كمية كافية ومتنوعة من الغذاء وليس لخصائص الأفراد أنفسهم.

الكلمات الدالة: دليل الفرص البشرية، عدم المساواة في الفرص، سهولة الوصول إلى الأمن الغذائي، مستوى الفقر، دليل استهلاك الغذاء

## 1. INTRODUCTION

Nowadays, pursuing the equalization of opportunities at all stages of an individual's life is one of the main objectives of the Egyptian government. Equality of opportunity means that the person's chances in access to services or opportunities as education, quality job and adequate consumption levels are unrelated to circumstances or characteristics of the person at birth such as gender, area of birth, parents' education, etc. (Vélez, et al., 2012).

Inequality is usually measured using consumption, income, or wealth indicators. Thus, this study shifting the debate from inequality of income or earnings to inequality of opportunities and to the policies needed to tackle that inequality. Accordingly, when the focus shifts to the equalization of opportunities, the need to reduce inequity is easier to achieve (World Bank, 2009). The inequality of opportunities may be in education, health utilization, housing services, etc. However, this study is concerned -for the first time in Egypt- about the inequality of opportunities in food security in terms of its accessibility.

Food security is measured through three main areas, namely; food availability, food accessibility and food utilization. Food availability is the physical presence of food in the area of concern. Food accessibility is the household's ability to acquire a sufficient quantity and quality of food, through home production, stocks, purchases and borrowing. Food utilization means the proper biological use of food and the individuals' ability to meet their dietary needs for an active and healthy life (World Food program, 2011). Food may be available but not accessible to certain households if they cannot acquire a sufficient quantity or diversity of food. Accordingly, this study is concerned only by the inequality of opportunities in food accessibility.

This study measures the inequality of opportunities in food security by using Human Opportunity Index (HOI). HOI is a composite indicator that combines two elements: (i) the level of coverage of basic opportunities, (ii) The level to which distribution of those opportunities is restricted by circumstances of individual at birth (World Bank, 2009).

## **2. OBJECTIVES OF THE STUDY**

The main objectives of the study could be summarized in the following:

- 1- Measure the inequality of opportunities in food accessibility based on two indicators: First, quantity bases (whether all individuals have equal opportunity to acquire sufficient quantity of food based on their poverty status), Second, quality bases (whether all households have equal opportunity to acquire dietary diversity based on their Food Consumption Score, FCS). Additionally, the study constructs a composite index depending on these two indicators to measure the overall inequality of opportunities in food accessibility and detect the urban-rural gap.
- 2- Show whether the differences in HOIs between urban and rural areas are due to differences in coverage or due to differences in distribution of circumstances.
- 3- Examine the main determinants affect the food accessibility (based on quantity and quality bases) using the Binary Logistic Regression Model.

This analysis allows policymakers to diagnose if public policies are being effective in expanding and allocating opportunities equitably, and which demographic and regional characteristics (or circumstances) should be taken into account in the revision of targeting mechanisms.

## **3. LITERATURE REVIEW**

The study has two main topics, one is related to food security and the other is related to the inequality of opportunities. Therefore, the literature review is divided into

twofold; determinants of food security and the inequality of opportunities in nutrition using the HOI.

### **3.1. Determinants of food security**

There are many studies tried to determine the determinants of food security using the binary Logistic Regression Model. Sidhu, et al. (2008) studied the food security determinants in a food-surplus area, in the state of Punjab, India. The study showed that the level of income and family-size has been found as the most significant factor affecting food security. Tefera, (2009) studied the major determinants of rural household food insecurity in Kuyu District, Central Ethiopia. Ownership of farm oxen and livestock, level of fertilizer application and family size were among the critical factors determining food security status of the farm households.

Arene, et al. (2010) recognized the determinants of food security among households in Nsukka metropolis of Enugu State, Nigeria. It was found that about 60 percent of the households are food insecure. Using the Binary Logistic Model, it was identified that income and the age of household head are the main determinants of food security. Bashier, et al. (2010) aimed to evaluate the major determinants in the rural and peri-urban areas in Pakistan. They found that 18 percent of the households were food insecure. Livestock assets, educational levels, number of earners, household's income and income in the form of aids, gifts from relatives or any aid giving agency had a significant impact on the household food security.

The World Food Program (WFP, 2011) in Egypt implemented a study with the Central Agency for Public Mobilization and Statistics, CAPMAS. The study examined the intensity of food security in Egypt based on its factors. The main sources of data for the study were the HIECS 2009; and the Demographic and Health Survey for Egypt, EDHS 2008. The results of the study showed that poverty and food

insecurity are highly correlated. Additionally, the results of the main factors affecting food insecurity showed that economic access to food is the most significant food security concern in Egypt. Additionally, joint IFPRI-WFP with CAPMAS, 2013 implemented a study in Egypt using HIECS 2010-2011. The results show that there is a significant relationship between income poverty and poor access to food, underlining that the issue of food insecurity in Egypt is mainly represented in economic access. Also, those who are income poor and have poor food consumption also increased from 15 percent in 2009 to 18.2 percent in 2011. The results also suggest that 35 percent of Egyptians suffer from poor dietary diversity and a further 56 percent are on the borderline. There is a strong correlation between poverty and poor dietary diversity.

### **3.2. Inequality of opportunities in nutrition using HOI**

Many studies focused on measuring the inequality of opportunities in food utilization using the HOI. The malnutrition indicators: stunting, wasting or obesity and underweight are used to assess food utilization. Singh, (2011) measured the inequality in access to food utilization for Indian children using the HOI. The results show the overall high level of inequality of opportunities in malnutrition indicators due to regional disparities. The southern region had the highest HOI value while the regions like Central and Eastern regions had low HOIs values. The results show also that parental education is one of the significant factors affect the accessibility to the opportunities. Assaad, et al. (2012) examined the patterns of inequality of opportunities in food utilization for children under five in selected Arab Countries and Turkey. The study shows that children in Arab countries and Turkey suffer from inequalities of opportunities in nutrition, particularly in Egypt, where the total inequality is rising over time. Regional disparities, demographics and parent's

education are the most significant circumstances that affect the inequalities in nutrition of children.

Vélez, et al. (2012) measured the equitable access to opportunities in Egypt during (2000-2009) using EDHS and HIECS. The study used the HOI to examine the evolution of 16 basic opportunity indicators grouped in four sectors. The results show that the opportunities are improved during the last decade by a mixture of better access and equal opportunities, but access has the significant role. The urban-rural gap was partially reduced during the last decade but still there is a significant gap for all HOI indices. The most five important circumstances are parent's education, income per capita, urban and rural areas, number of siblings and regional location.

To sum up, it is clear from previous literature review that most studies focused on measuring the determinants of food security. Additionally, previous studies measure only the inequality of opportunities in food utilization using HOI. While, this study is the first attempt to measure the inequality of opportunities in food accessibility using the HOI.

#### **4. DATA AND METHODOLOGY**

##### **4.1. Data Source**

This study depends on data from "Egypt - Household Income, Expenditure, and Consumption Survey, 2010/2011" that is conducted by Central Agency for Public Mobilization & Statistics - Arab Republic of Egypt, CAPMAS. The sample is representative as it has been proportionally distributed on the governorate level and between urban and rural areas within each governorate. This study used 7719 households which are 50% of the non-panel data and it is the only available data on the website of CAPMAS.

## 4.2. Methodology

### a) Binary Logistic Regression Model

This study examines the main determinants of household's food accessibility using the Logistic Regression Model;

$$P(Y = 1 / X) = \frac{1}{1 + e^{-z}}, \text{ where } Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p,$$

where  $x_i = (x_{1i}, x_{2i}, \dots, x_{mi}), i=1, \dots, n$

The dependent variable Y is the access to a certain service, the explanatory variables X are the related circumstances as gender, regions, parental education, etc., m is the total number of circumstances and n is the total number of households, and the  $\beta_i$ 's are the corresponding parameters. For example: in case of food accessibility based on quantity bases,  $y = 1$  for non-poor individuals reflecting good opportunity to acquire sufficient quantity of food and  $y = 0$  for poor individuals, i.e., has weak opportunity to acquire food.

### b) Human Opportunity Index

A simple *interpretation of the HOI* is a measure of access to (or coverage of) essential services, discounted or penalized by the inequality of access across the potential beneficiaries. Therefore the HOI improves either by increasing access to services (the scale effect) and/or by making access more equitable (the distribution effect). The HOI range is from 1 to 100, and it increases with the global rate of coverage and that it decreases with the differences in coverage between the different groups of circumstances.

The HOI is a measure of access to a specific human opportunity based on discounting the rate of global coverage, C, with penalization P associated with inequality of opportunities.

$$HOI = C - P$$



Where the penalization is given by  $P = (C * D)$  and  $D$  is the dissimilarity index, which measures the difference between the rates of coverage of an opportunity across different groups of circumstances. The  $D$  index can be interpreted as the fraction of people to whom a service or good must be reassigned as a percentage of the total number of people who have access to this good or service. Thus,  $(1-D)$  would represent the percentage of opportunities available that are assigned correctly:

$$HOI = C - P = C *(1-D)$$

The penalization is chosen in such a manner that it be zero if all the rates of coverage across all the groups of circumstances are identical.

Computing the penalization for inequality of opportunities,  $P$ , requires the identification of all the groups of circumstances with rates of coverage below the average. We refer to these as the groups vulnerable to human opportunity. For each group vulnerable to opportunity,  $k\bar{M}_k$  is the number of people who have access to a good or service, so that their rate of coverage is the same as the average, while  $M_k$  is the number of people in group  $k$  with access less than the average. Thus  $M_k - \bar{M}_k$  is the difference in opportunities within the vulnerable group  $k$ . The penalization is the sum of the differences in opportunities of all the vulnerable groups (denominated the total difference in opportunities) divided by the total population ( $N$ ):

$$P = \frac{1}{N} \sum_{k=1}^p (M_k - \bar{M}_k)$$

Intuitively,  $P$  can be interpreted as the percentage of people whose access would have to be reassigned to people in groups with lower rates of coverage to reach equality of opportunities. If all the groups have exactly the same rate of coverage, then the penalization is zero, and no reassignment would be necessary. As long as the coverage approaches universality for all groups the reassignment required will be

close to zero<sup>1</sup>.

However, the global coverage,  $C$ , is calculated using the *Logistic Regression Model* utilizing all the related circumstances to assess the impact of these circumstances on each opportunity and to calculate the average ( $C$ ) using the predicted probabilities.

The HOI has three important properties: first, it is defined as the rate of coverage that is responsive to inequality of opportunity. Thus, its value decreases as the D-index of a given opportunity increases. Second, if no one loses access and at least someone gains access, then the HOI will always increase regardless of whether this person belongs to a disadvantaged group. Third, when the rate of coverage of all the groups of circumstances increases proportionally, the HOI will increase in the same proportion (Vélez, et al, 2012).

### c) Decomposition of HOI

One property of the HOI is that its changes are additively decomposable. Any change in the HOI can be decomposed into distribution and scale effects. The differences in HOI can come from the differences in the overall coverage, scale effect, or differences in the distribution of circumstances among households, distribution effect (World Bank, 2009). This study examines the differences in HOI of food accessibility among urban and rural areas. Any change in the HOI could be decomposed into a scale effect,  $\Delta\bar{p}$ , and a distributional effect,  $\Delta D$ , as follows:

$$\text{Differences in HOI} = HOI^{urban} - HOI^{rural}.$$

Where the scale effect (access effect),  $\Delta\bar{p}$  and the distributional effect,  $\Delta D$ , are defined as follows:

<sup>1</sup> For more details see (presentation of methodology of the Human Opportunity Index made by Molinas, et al (2010), a World Bank/LAC document)

$$\Delta \bar{p} = \frac{\bar{p}^{urban}(1-D^{rural})}{HOI^{urban}},$$

$$\Delta D = 1 - \Delta \bar{p}$$

## 5. RESULTS

### 5.1. Coverage of Food Opportunities

This section addresses the first component of the Human Opportunity Index, coverage of food opportunities. It provides detailed information on food accessibility in terms of its quantity and quality, without reference to the equity of their distribution, which is addressed in the following section.

#### 5.1.1 Food accessibility in terms of its quantity (Poverty Status)

One of the main goals of this study is to show whether all individuals have equal opportunity to access to food in terms of its quantity. It is assumed that monetary poverty status is a good proxy of access to adequate food quantity. The data of HIECS 2010-11 shows that the overall percentage of non-poor individuals in Egypt is 75.4%. Figure (1) illustrates that individuals in Metropolitan region tend to have the highest probability to access to adequate food quantity as this region has the highest percentage of non-poor individuals compared with the other regions. Differences in poverty prevalence across the regions are statistically significant using the T-test. In general, urban areas have higher probability to acquire sufficient food quantity than rural areas as, 84.9% of individuals in urban areas are non-poor compared to only 68.5% in rural areas.

As shown also in Figure (1) the poverty incidence decreases when the head of household modifies his educational level. Around 95% of individuals with heads hold university certificate or above are non-poor compared with only 60.3% for those who have illiterate heads. Additionally, individuals with female headed households tend to

be non-poor more than those with male headed (78.1% vs.75%). Table (5) shows that individuals whose household heads have permanent non agriculture works are more likely to be non-poor than those whose household heads have temporary agriculture works.

➤ *Main Determinants of Food accessibility in terms of its quantity*

To examine the main determinants that affect the accessibility of food in terms of its quantity (poverty status), Binary Logistic Regression model is used. The results of the model (Table 1) show that the age, educational level, employment stability and main economic activity of household head, household size, having more than three individuals in room, place of residence, having a ration card, type of dwelling, tenure of dwelling, percentage of children, elder, working individuals, holding secondary or university certificate in household in household, percentage of food expenditure from total expenditure, percentage of having income and insurance in the households are the main factors affect poverty status of individuals. Accordingly, these indicators are considered the main determinants affect the accessibility of adequate food quantity.

### 5.1.2 Food accessibility in terms of its quality (FCS)

Food Consumption Score (FCS) is considered as an indicator to measure the food accessibility based on quality bases. FCS is a standard tool that used to reflect dietary diversity as well as frequency of consumption and it is generally one of the most commonly used food security indicators. FCS is a score that is calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey (WFP, 2008).

Each food group is allocated a score or weight based on its nutrient density (Table 2). The frequency of each group is the number of days consumed by the household

during the last 7 days and this frequency is multiplied by group's score and then added for all food groups. The total number for all food groups is 112. The higher the FCS, the more diverse is the diet. However, there are some households whose consumption score is zero, i.e. households might ate all their meals outside home during the last 7 days. Accordingly, the FCS for those households is adjusted by the median score adopted in each region.

According to WFP methodology, appropriate thresholds were adopted to the FCS, where the FCS is recoded from a continuous variable to a categorical variable to create the food consumption groups. There are three main thresholds adopted by WFP, a score of below 28 was set to have poor food consumption level. Between 28 and 42, households are assessed having borderline food consumption level. Greater than 42, households fall in the acceptance level of FCS. The value of 28 comes from an expected daily consumption of bread, vegetables, oil and sugar. The value 42 comes from an expected daily consumption of the previous items complemented by a frequent 4 days/week consumption of pulses and a heavy consumption of oil.

A score of 42 was set as a cutoff point, if the household's FCS is less than 42; it indicates that the household has less ability to access to adequate different food groups, not acceptable food consumption level. On the other hand, if the household's FCS is greater than 42, it indicates that it has the ability to access to adequate different food groups, i.e.; acceptable food consumption level. The study deals with those on the border line as they do not have acceptable food consumption level as they may fall into the poor food group if food prices increases or if they suffer from any economic shock. Thus, households were classified into two categories; non-acceptable and acceptable food consumption level. Overall, data shows that 34.1% of households have non-acceptable FCS, and 65.9% have acceptable FCS.

As indicated by Figure (2), households in Metropolitan region are most likely to diversify their food than those in other regions, where the percentage of households with acceptable FCS reached 76.4% compared to only 55.6% in Rural Upper region. In general, households with acceptable FCS in rural areas are 62.2%, while it increased to 70.1% among households in urban areas. This indicates that households in urban areas have higher probability to diversify their food than those in rural areas. There is a significant difference in the incidence of having acceptable FCS among areas using T-test.

Figure (2) also illustrates that households with heads hold university certificate or above have the highest percentage of acceptable FCS; this indicates that improving the educational level of household heads increases the likelihood of households to diversify their food. Households with male headed have higher incidence to diversify their food than those with female headed.

➤ *Main Determinants of Food accessibility in terms of its quality (FCS)*

To assess the main determinants that affect the accessibility of food diversity, Binary Logistic regression model is used. As shown in Table 3, the poverty status of households, household size, region, and connection to sewerage system, tenure of dwelling, percentage of illiterate individuals in household and percentage of food expenditure from total expenditure are the most significant factors affect the diversity of food.

### 5.1.3 Food accessibility based on the composite index

The study constructs a composite index depending on the previous two indicators to measure the overall accessibility of food. This composite index represents the overall accessibility of food, where the household has overall access to food if it is non poor

household that can acquire sufficient food quantity and has an acceptable FCS. The data shows that 56.3% of households have overall food accessibility as they are non-poor with acceptable FCS.

Overall, households in rural areas have lower probability to access to adequate food based on quality and quantity bases than those in urban areas as the percentages of non-poor households with acceptable FCS reached only 50% in rural areas compared with 63.5% in urban areas. Differences in overall food accessibility across the areas are statistically significant using T-test. Figure (3) shows that Metropolitan region has the highest probability to access to adequate food (72.3%), while this percentage decreased to only 33% among households in rural Upper region.

It is also shown from Figure (3) that the percentages of households with overall food accessibility increase when the educational level of household head increase. Male headed households are more likely to have overall food accessibility than those female headed households (57% vs. 54%). It is clear from Table (5) that households who do not have ration cards with household size ranges from 1 to 3 members and their heads are employer with permanent non agriculture works have higher probability to have overall food accessibility than other households.

➤ *Main Determinants of Overall Food accessibility*

To assess the main determinants that affect the overall food accessibility; Binary Logistic regression model is used. Table 4 shows that the household size, region, having a ration card, tenure of dwelling, and having more than three individuals in room are the most significant factors affect the overall food accessibility among households.

## 5.2 HOIs Measurement for Food Accessibility in Egypt

Most policy makers would prefer to have sufficient resources to provide basic opportunities to all households in society, no matter their background. HOI helps estimate how equitably access to basic opportunities is distributed throughout the population, that is, whether the distribution of opportunities is associated with circumstances. Thus the HOI can be interpreted as the number of existing opportunities in a given society that have been allocated equitably.

This study measures the inequality of opportunities in food accessibility based on quantity and quality bases as well as for the overall index using the HOI. The index assesses the importance of both improving overall access to food and ensuring its equitable allocation.

Overall, Table (6) shows that only 48% of all opportunities needed to ensure universal access to food are both available and allocated equitably. However, as mentioned previously, there are 56.3% of households have overall food accessibility, or 56.3% of the opportunities needed for universal coverage were available. Out of these, there are 8.3% points were not allocated equitably. As a consequence, only 48% (56.3% minus 8.3%) of needed opportunities for universal access were available and distributed equitably.

Regarding urban-rural differences, the table shows that urban areas offer better food opportunities for households than rural areas. The overall value of HOI index – the aggregate of the two opportunities- reached 55.8% and 41.1% in urban and rural areas respectively. However, as mentioned previously, the percentage of households who have overall food accessibility reached 63.5% and 50% for urban and rural areas respectively. This means that there are 7.7 and 8.9 percentage points in urban and



rural areas respectively, the opportunities were not allocated equitably among households.

Additionally, the better situation of human opportunities in urban areas than those in rural areas is mainly due to the gap in food accessibility based on quantity bases (there are 21 percentage points gap) more than that based on quality bases (8 percentage points gap) (Table 6-fourth column).

### **5.3 Decomposition of differences in HOIs among urban and rural areas**

It is clear from Table (6) that the HOI of food accessibility based on quantity bases reached 77.1% in urban areas, while it decreased to 56% in rural areas. The differences in the HOI among areas are 21.1 percentage points. This difference is decomposed into 90% due to the differences in the overall coverage of individual's accessibility to sufficient food quantity among areas, scale effect, while the other 10% is due to the differences of the distribution of circumstances of individuals among areas, distribution effect.

As clear from Table (6) that the HOI for food diversity is only 64.4% in urban areas and 56.9% in rural areas. The difference in the HOIs among areas is only 7.5% points. This difference is mainly due to the differences in the overall average of household's accessibility to food diversity among areas, scale effect, while almost no impact of individuals' circumstances on the difference between areas in food diversity.

Finally, Table (6) shows that the HOI for overall food accessibility reached 55.8% in urban areas and decreased to 41.4% in rural areas, with 14.4% points difference. This difference is decomposed into 94.2% due to the difference in the overall household's accessibility to adequate quantity and food diversity (overall accessibility) among areas, while only 5.8% is due to the differences of the distribution of circumstances of households among areas. Accordingly, the main difference in overall food

accessibility between areas is returned to household's accessibility to adequate quantity and food diversity and not to the households' circumstances. *Accordingly, differences between areas regarding the opportunities in food accessibility, as measured by HOI, is in general driven by an increase in access rather than in the degree of equality of opportunity.*

## 6. CONCLUSION AND POLICY IMPLICATION

Decomposition of differences in HOIs among areas shows that the scale effect, due to the overall coverage of opportunities is the dominant effect that affects the inequality of opportunities in food accessibility among areas. So, public authorities are indeed expected to play a more vital role in the process of increasing the overall coverage of opportunities of food accessibility.

The results also show clearly that the HOIs for urban areas are higher than those in rural areas, means that households in urban areas have higher ability to access to food based on equal opportunity principle than those in rural areas. This difference in indices is due to the overall coverage of food accessibility. Therefore, public programs should apply more policies to alleviate poverty especially in rural areas in order to decrease the gap between urban and rural areas. Most of the below suggested policies are concerned about poverty as it is one of the most significant determinant that affect the accessibility to quantity and diversity of food. Alleviation of poverty will guarantee the acquirement of adequate different food groups.

- Focusing on the value of education of head by state directions responsible for adult education and combat against illiteracy by literacy programs, especially in rural areas and set clear strategies with clear timed goals to tackle this issue.

- University education is found to be of vital importance in reducing poverty and increasing food diversification. In this regard, the recently introduced private universities would play critical role.
- The Ministry of Health with the help of the national and international institutions should implement a wise policy of birth control, since every increase in the household size increases the probability of household to fall into poverty and decreases its opportunity to access to adequate food. Family planning programs should prove their effectiveness in the alleviation of poverty.
- The necessity for public authorities to play more effective and positive role in sponsoring and supporting the sources of food as well as to facilitate access for the poor rural population to basic services like education and health.

All the above policies help in increasing the overall coverage of food accessibility based on quantity and quality bases, which lead to increase the number of existing opportunities that have been distributed based on an equal opportunity principle. More concerning in rural areas will increase the equal opportunity of accessibility to food and decrease the gap compared to urban areas.

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APPENDIX

Figure 1: Percentage of non-poor individuals according to different characteristics

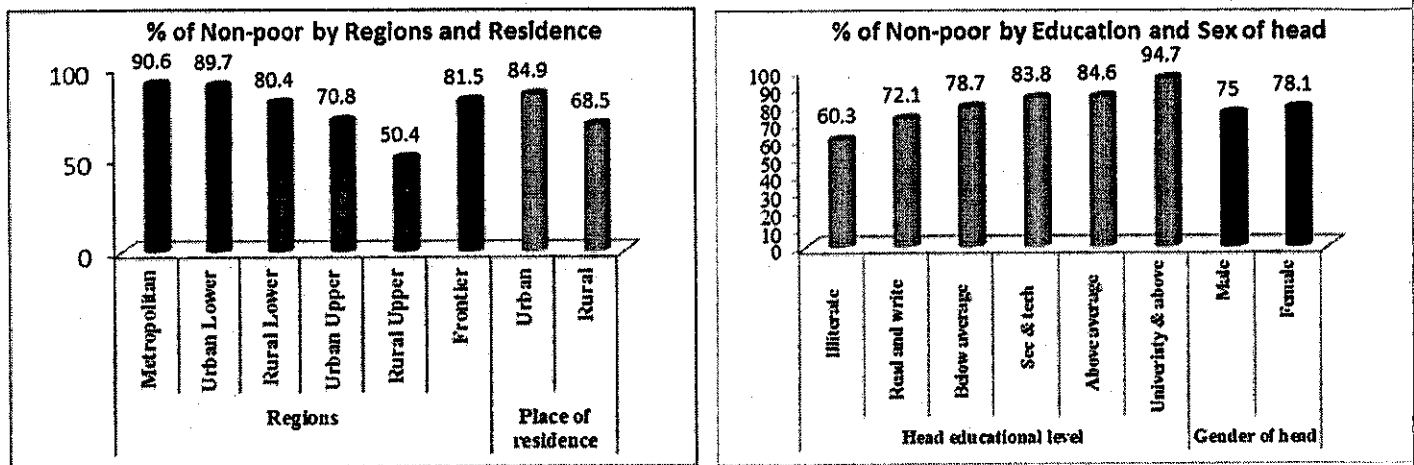


Figure 2: Percentage of households with accepted FCS according to different characteristics

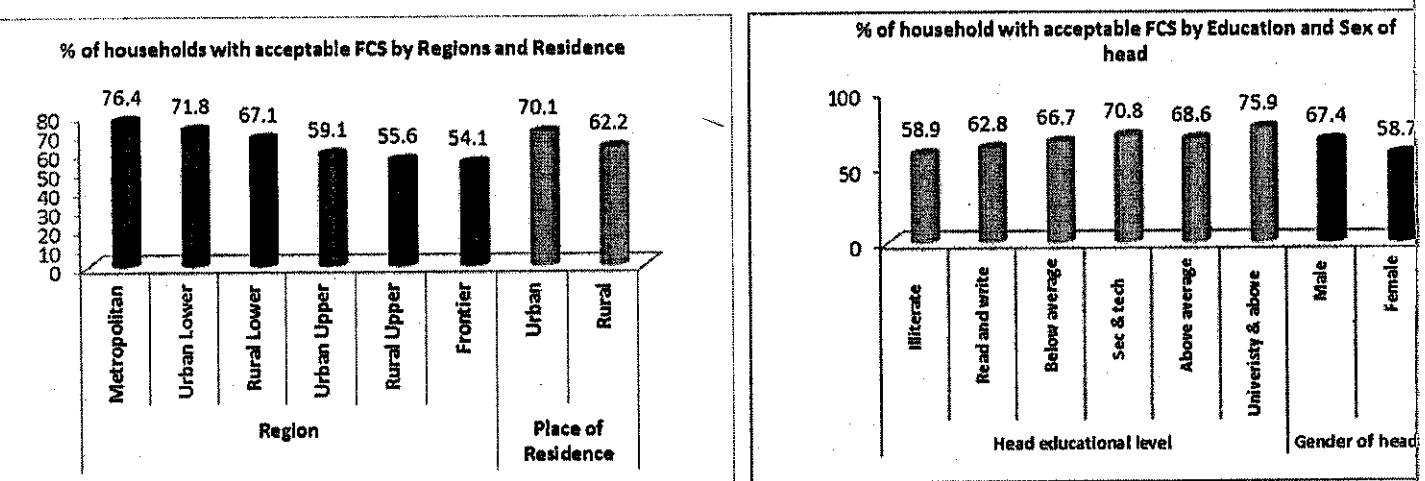
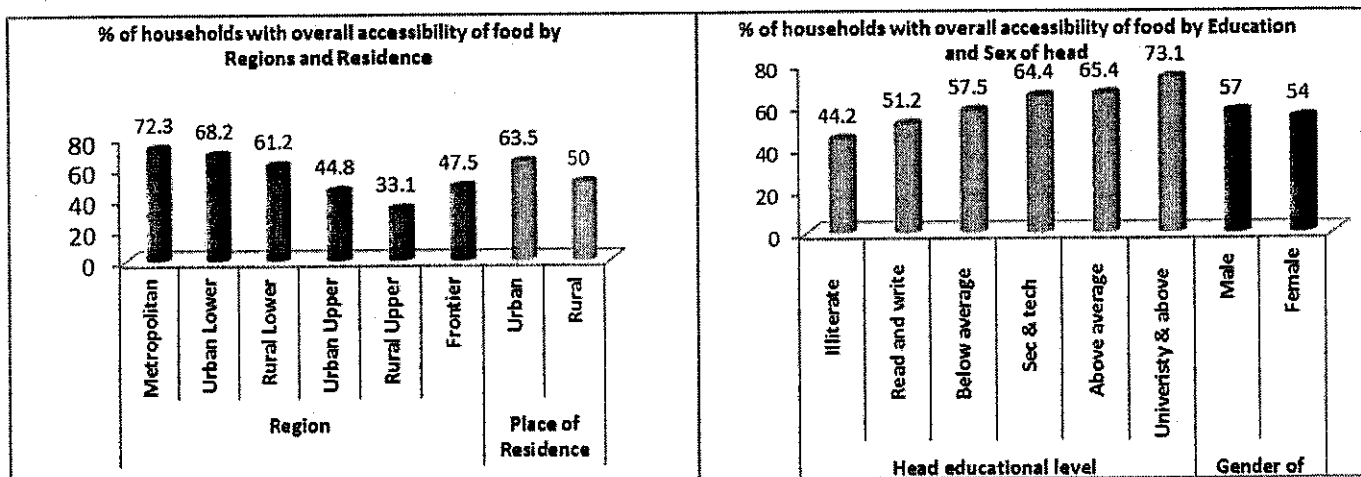


Figure 3: Percentage of households with overall accessibility of food according to different characteristics



**Table 1: Results of the Logistic Regression Model to assess the main determinants of accessibility of food in terms of its quantity (Poverty Status)**

Definition	Measurement	Odds Ratio	Sig.
Poverty status (The dependent variable)	Y=1 (non poor), Y=0 (poor)		
<b>Explanatory variables</b>			
Age of household head	Continuous	0.8947929	0.000
Level of education of household head	Illiterate (Ref)		
	read and write	1.459157	0.012
	below average degree	1.580944	0.004
	secondary degree	1.69068	0.001
	above average degree	2.197748	0.005
Employment stability	university and above	2.526433	0.001
	Permanent (Ref)		
Main economic activity of household head	temporary	0.7221057	0.018
	Agriculture (Ref)		
Household size	non agriculture	1.329144	0.046
	Continuous	0.673849	0.000
Crowdedness	Not crowd (Ref)		
	crowd	0.4323437	0.000
Area of residence	Urban (Ref)		
	Rural	0.1560884	0.014
Having a ration card	Yes (Ref)		
	no	1.659931	0.000
Type of dwelling	Apartment (Ref)		
	house	0.6866818	0.002
	room	0.5634824	0.001
	other	0.4946616	0.012
Tenure of dwelling	Rented (Ref)		
	owned	2.732555	0.000
	provided free	1.963109	0.000
percentage of children less than 14 in HH	Continuous	2.39704	0.005
percentage of elder individuals above 65 in HH	Continuous	2.719869	0.017
percentage of working individuals in HH	Continuous	2.934375	0.001
percentage of holding secondary certificate in HH	Continuous	2.220711	0.01
percentage of holding university certificate in HH	Continuous	18.21913	0.000
percentage of food expenditure from total expenditure	Continuous	0.020082	0.000
percentage of having income in HH	Continuous	2.023947	0.033
percentage of having insurance in HH	Continuous	4.57959	0.000

**Table 2: Main Food groups and weights used to calculate the FCS**

Food items	Food groups	Weights
Maize, maize porridge, rice, millet pasta, bread and other cereals.	Main staples	2
Potatoes, sweet potatoes, other tubers.	Pulses	3
Vegetables and leaves.	Vegetables	1
Fruits.	Fruits	1
Beef, goat, poultry, pork, eggs and fish.	Meat and fish	4
Milk yogurt and other diary.	Milk	4
Sugar, sugar products and honey.	Sugar	0.5
Oils, fats and butter.	Oil	0.5

**Table 3: Results of the Logistic Regression Model to assess the main determinants of accessibility of food in terms of its quality (FCS)**

Definition	Measurement	Odds Ratio	Sig.
FCS (The dependent variable)	Y=1 (accepted FCS), Y=0 (non accepted FCS)		
<b>Explanatory variables</b>			
Poverty status	Poor (Ref)		
	non poor	1.345359	0.011
Employment stability	Permanent (Ref)		
	temporary	0.7827543	0.071
Household size	Continuos	1.067394	0.028
Region	Metropolitan (Ref)		
	lower urban	0.7208413	0.022
	lower rural	0.4882301	0.000
	upper urban	0.4380486	0.000
	upper rural	0.3572861	0.000
	frontier	0.2364054	0.000
Connected to swerage system	Connect to public network (Ref)		
	No connection	1.267814	0.022
Tenure of dwelling	Rented (Ref)		
	owned	1.439558	0.001
	provided free	1.614577	0.001
percentage of illiterate people in HH	Continuos	0.4273954	0.001
percentage of food expenditure from total expenditure	Continuos	2.872073	0.008

**Table 4: Results of the Logistic Regression Model to assess the main determinants of overall accessibility of food**

Definition	Measurement	Odds Ratio	Sig.
Having overall food accessibility (The dependent variable)	Y=1 (yes), Y=0 (no)		
<b>Explanatory variables</b>			
Household size	Continuous	0.852064	0.000
Region	Metropolitan (Ref)		
	lower urban	0.711341	0.017
	Lower rural	0.5714069	0.000
	upper urban	0.2994908	0.000
	upper rural	0.2913217	0.000
	frontier	0.2723796	0.000
Having a ration card	Yes (Ref)		
	no	1.20247	0.051
Tenure of dwelling	Rented (Ref)		
	owned	1.50566	0.000
	provided free	1.4399	0.012
Crowdedness	No crowdedness (Ref)		
	Crowdedness	0.3556539	0.000



**Table 5: Percentage of non-poor individuals, individuals with acceptable FCS and overall accessibility by Household characteristics**

Category	% of non-poor individuals	% of households have acceptable FCS	% of overall food accessibility among households
<b>Household Size</b>			
1 to 3	95.4	62.9	61.0
4 to 5	85.3	67.9	60.5
6 to 7	61.4	65.7	43.7
8 to 9	46.5	68.9	35.3
Over 10	34.5	66.3	26.8
<b>Employment Status of Household Head</b>			
Wage Earner	75.8	68.0	57.2
Employer	73.7	67.5	57.6
Self-employed	71.7	66.1	54.3
Unpaid Worker	72.3	35.4	18.9
Out of Labor Force	78.4	60.6	54.8
<b>Work Stability of Household Head</b>			
Permanent	76.8	68.8	58.6
Temporary	60.2	59.4	44.7
<b>Economic Activity of Household Head</b>			
Non Agriculture	78.6	66.4	58.2
Agriculture	62.5	63.5	47.4
<b>Holding Ration Card</b>			
Yes	71	64	53
No	84	70	63
<b>Total</b>	<b>75.4</b>	<b>65.9</b>	<b>56.3</b>

**Table 6: Decomposition of the differences in HOIs among urban and rural areas into the scale and distribution effect**

Opportunity	HOI in total Egypt	HOI in urban areas	HOI in rural areas	Difference in HOI	Decomposition %	
					Access	Equality of opportunity
Poverty Status	64.4	77.1	56	21.1	90	10
FCS	60.7	64.4	56.9	7.5	99.7	0.3
Composite Index	48	55.8	41.1	14.4	94.2	5.8