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ABSTRACT

Per capita dietary energy supply exceeds per capital dietary energy consumption in Pakistan. Almost half of its population is reported food insecure in various studies. Whether this high incidence of food insecurity persists in the country or not is understudied particularly when food security is measured from access (physical and economic) to food. This study bridges this literature gap. Using household expenditure survey based method to measure dietary energy consumption at household level as a measure of food security, it finds out region wise and quintile-wise trends in incidence of food insecurity in Pakistan during 2004-16. Seven rounds of HIES conducted during 2004-16 are used for analysis. Results show food insecurity trends are fluctuating at national and sub-national levels in Pakistan. It is increasing during 2004-08 and 2011-14 while decreasing during 2009-10 and 2014-16. Increasing trend is found in food insecurity at points in time where natural (earthquake and floods) or manmade (food price crisis, conflict) affected different areas of the country. Households' expenditure quintile-wise trends of food insecurity show that bottom quintile has stable and high incidence of food insecurity. Second and third quintiles also have high level food insecurity. Additionally, these quintiles show high vulnerability to various shocks affecting their purchasing power. Lower but stable incidence of food insecurity in top quintile shows that apart economic aspects, food security has non-economic aspects as well like nutrition awareness/education. Provincial analysis show incidence of food insecurity is highest in Sindh and Balochistan while lowest in KPK. From our analysis it is implied that social safety nets and emergency relief efforts by government though protect food insecure population against shocks; they are not sustainable solutions. It is implied from trends analysis that sustainable solutions to protect both physical and economic access to food are required in Pakistan to cut hunger to lower levels and reduce people vulnerability to various shocks.

Keywords: Food Insecurity, Minimum Dietary Energy Consumption and Requirement, Calories, Pakistan, Urban, Rural, Punjab Sindh, Balochistan, KPK

1. INTRODUCTION

Food security is much emphasised in international commitments like millennium development goals (MDGs) and sustainable development goals (SDGs). It shows its equal importance for both developed and developing countries. Among prominent international efforts to monitor progress towards MDGs and SDGs, The State of Food Insecurity (SOFI) in the world report by FAO has gained special attention. It shows 815 million people are still undernourished in the world [FAO (2017)]. During 2016 an upward trend is observed in the number of undernourished people around the world. Majority of this population lives in underdeveloped and developing countries. Asia hosts the maximum number of food insecure. This situation poses serious threats to realisation of SDG target (2.1) i.e. "*By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.*[1]"

Reported statistics has induced researchers all over the world to find out the incidence of food insecurity and its causes. Literature shows prevalence of under nourishment (PoU hereafter) depends upon factors like economic growth, infrastructure, natural resources that assist in food production, internal peace and security situations, macroeconomic and sector specific policy environments, institutional stability and agricultural growth etc. Most of the developing countries that are facing challenges on above mentioned areas are also lagging behind in ensuring food security for all [FAO (2017)].

Pakistan is also no exception here. Being a resource scarce and developing country it is also facing challenges to ensure food security for all and is struggling on many socioeconomic and political fronts since years. Regional overview of Food Insecurity in Asia and the Pacific region [FAO (2016)] report shows that after Afghanistan (–1.6 percent per annum) Pakistan has performed worst in Southeast Asia in reducing PoU (–0.3 percent per annum) during 2011 to 2015. Pakistan's poor performance (ranked 77th higher than India (74th)) at Global Food Security Index (GFSI) [EIU (2017)] also complements these findings.

Food security definition as proposed in 1996 World Food Summit is "Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". This definition shows that this issue is not static rather dynamic in nature. Hence, optimal policy formulation to combat food insecurity requires

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[1]https://www.un.org/sustainabledevelopment/hunger/

continuous monitoring of the incidence of food insecurity and its causes. But around the world generally and in Pakistan specifically cross-section evidences dominate food security literature. Though comparative static and dynamic analysis of food insecurity is important, it lacks in the literature about Pakistan. [SDPI, SDC and WFP (2009)] compares food insecurity status for two years i.e. 2003 and 2009 at district level in Pakistan. Except this study we could not find any study presenting food security status over time in Pakistan. Since then eight years have passed but to our knowledge, none of the studies have investigated food insecurity trends post 2009. This situation makes Pakistan an interesting case to study trends of food insecurity across time, region and income groups. This study adds value to existing literature by producing food insecurity trends during 2004-16. The first objective that the current study intends to achieve is to measure and analyse trends in the incidence of food insecurity in Pakistan at national, regional (urban/rural) and provincial levels. Second objective is to study the role of economic status of households in the incidence of food insecurity through quintile level analysis of food insecurity trends.

The current study is organised in the way that Section 2 is about literature review, Section 3 presents methodology and data, Sections 4 and 5 contain results and conclusion respectively.

2. LITERATURE REVIEW

Economics literature about different dimensions of household well-being plays an important role in the field of economics. Among other dimension of household well-being, food security is an important one [Rizov, *et al*. (2014)]. It is a very diverse concept with varied nature and scope. It is evolving over time as the societies are becoming more civilised. Food security literature can be traced back to 20th century (1970s). In the beginning food security was considered as a supply side issue both at national and global levels. Then in 1980s both individual and household level access (both physical and economic) to food came into focus and debate about demand side issues of food insecurity started.

Since 1970s literature presents a number of food security definitions and conceptual models [see for example Maxwell and Frankenberger (1992)]. FAO (2002) defined food security as "food security exist when all people, at all time, have physical and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy lifestyle". A country is considered food secure if its' food supply (per capital food availability) is enough to meet food demand (per capita food required). While, if people in a country are facing inadequate economic, social or physical access to food then food insecurity exists in that country. According to most recent definition, food security has four dimensions i.e. food availability, access to food, utilisation and stability. Food availability describes supply side of food

security. Its determinants include local food production, net food exports (imports minus exports), level of food stocks, food stamps/aids or transfers [Wahab and Applanaidu (2015)]. Food access is defined as affordability and physical access to nutritious food. It depends on individuals' entitlements (income) that are rooted in their endowments [Sen (1981)]. These endowments are in control of individual and can be transformed through production and trade into some type of food or commodity, exchangeable for food [Applanaidu and Baharudin (2014)]. Food utilisation determines nutritional status of individuals by satisfying his physiological needs. It is based upon quality of diet, clean drinking water, sanitation and health care. Stability of food security is determined by sustainable food availability and accessibility. All the four components jointly determine food security status at national as well as household level [Wahab and Applanaidu (2015)].

Food security is very crucial for the health of any nation. Ahmad (2009) emphasises that attention must be paid to food security at national, regional, household and individual levels. For it is crucial to maintain political stability, manage increasing population pressure, eliminate deprivation, and avoid conflicts and chaos [Ahmad (2009)]. Different reports generated by WFP, FAO and IFPRI highlight importance and state of food insecurity around the world. Recent study by Food and agriculture organisation [FAO (2017)] shows 815 million people are undernourished in the world. Also that world experienced an increase in the number of undernourished people during 2016 compared to 2015 (777 million). Specifically, it has rung alarm bells[2] for South-Eastern and Western Asia and sub-Saharan Africa. Food security situation deteriorated in these regions during 2016. These regions are home to vast majority of underdeveloped and developing countries. Ironically, most of the undernourished people live in Asia. It is in part due to its large population size. According to FAO (2016), Southern Asia could not even achieve MDG on hunger (36 percent reduction compared to target of 50 percent).

Different studies about South Asia conclude that governments in South Asia are trying their level best to assure food security and get rid of hunger and malnutrition. They are signing different development programmes as part of their food security policy. Unfortunately, these efforts have not been much fruitful in reducing food insecurity [Fayeye and Daramola (2007); Babatunde, *et al*. (2007); Oriola (2009)].

In Southern Asia, after Afghanistan (10 percent), Pakistan has performed worst by securing only 13 percent reduction rate.[3] Rather it has experienced an increase of 0.3 percent in PoU during 2010-15. It is well known that Pakistan is a developing country who is struggling on many socioeconomic and political fronts since years. According to SDPI, SDC and WFP (2009), food insecurity in

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[2]*The State of Food Security and Nutrition in the World 2017.*
[3]Regional overview of Food Insecurity in Asia and the Pacific region 2016.

Pakistan has worsened compared to 2003. An increase in number of extremely food insecure districts and a reduction in food secure are observed. Districts declared as vulnerable to food insecurity in [SDPI (2003)] have turned food insecure by 2009. This situation complements Pakistan's poor performance (ranked 77th higher than India (74th)) at Global Food Security Index (GFSI) [EIU (2017)]. Food price crisis during first decade of 21st century hit the developing world most adversely as it hosts large number of people living below $2/day poverty line. SDPI, SDC and WFP (2009) and FAO (2011) findings indicate worst hit of Pakistan by the food price crisis that reduced purchasing power of previously vulnerable groups.

Recent estimates reflect that almost 68 percent population of Pakistan cannot afford staple adjusted nutritious diet [MoPD&R and WFP (2016)][4]. Limited access of large number of households to nutritious diet poses challenges for food and nutrition security. Overall prevalence of undernourishment (PoU) in Pakistan is approximately 18 percent with more than 50 percent under five years age children affected from stunting, wasting or both; underweight is prevalent in 18 percent reproductive age women [NNS (2011); GoP (2017); IFPRI and AKU (2017)]. In under five mortality, Pakistan ranked 26th highest. Nutrition in Cities-Pakistan, Secondary data analysis for nutrition status of urban children (2016) report shows more than 50 percent children belonging to richest socio-economic strata are micronutrient deficient.

Literature suggests that food availability/supply is sufficient to feed the country. Estimated caloric availability from major food items is 2485 kcal per person/day [Pakistan (2016-17)] and it exceeds per capita daily requirement of 2350 kcal [PRSP-II (2003)]. But its urban and rural poor hardly end up with 1,786 and 1,848 kcal respectively [IFPRI and AKU (2017)]. Bagriansky (2017) and IFPRI and AKU (2017) identify problem in access or utilisation of food in Pakistan. Malnutrition is a later stage of food energy and nutrition deficiencies and is a phenomenon related to poor food intake and utilisation. Malnutrition driven public health problems and impairment of cognitive development later result in productivity losses. Estimates report that malnutrition[5] annually costs Pakistan USD 7.6 billion that is almost 3 percent of its GDP per year [Bagriansky (2017)].[6] Despite having ability to meet domestic food requirements, alarming rates of food insecurity and hence different forms of malnutrition (outcomes of lower food access and absorption) are posing a challenge to primary public health sector [NNS (2011); PDHS (2012-13) MICS (2011)] of Pakistan.

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[4]Ministry of Planning Development and Reforms and World Food Programme (2016). Minimum Cost of the Diet Pakistan. Islamabad, Pakistan 2016.

[5]In the form of lost labourers, healthcare expenses and lower productivity.

[6]The economic consequences of undernourishment in Pakistan: An assessment of losses.

Different indicators to capture different dimensions of food security and at different levels (global, regional, national and household) are used in literature. Analysis that focuses more on global food security consider food production as an important indicator to judge food security situation but if the study conducted is of national level then domestic production, power to import food and food aid are important factors. Similarly if the analysis is confined to individuals and household food security then income, dietary energy intake and intra household allocation of food, lack of money to purchase food [Rainville and Brink (2002)], food poverty [Charlton and Rose (2001); Mahmood and Shaikh (1991); gap between actual and required calories [(Omotesho, *et al.* (2010); Sidhu *et al.* (2008); Haile, *et al.* (2005); Bashir *et al.* (2014); Bashir *et al*, (2012a ,2012b, 2012c); Bashir, *et al*. (2007)] , difference between per capita calories available and required for the household [Haile, *et al.* (2005)], food frequency questionnaires with varying recall periods [Miller, *et al*. (2011)], Food security index [Omonona and Agoi (2007)], demand and supply of food [Ahmed and Siddiqui (1995)], anthropometric measures of nutrition [Guha-Khasnobis and Hazarika (2006)].To capture the vulnerability and sustainability feature of food security Feleke, *et al.* (2005) used volume and time of harvest of maize crop.

It is well understood that food availability doesn't ensure food security. Food security is achieved when individuals consume adequate quality and quantity of food. Hence, studies have also used different measures of access (physical and economic) to food like household income [Schichting and Ahmadi-Esfahani (2004)] and distance from market.

Empirical evidences about food insecurity prevalence in Pakistan are presenting worrisome picture of Pakistan [see for reference Guha-Khasnobis and Hazarika (2006); Bashir, *et al.* (2012a, 2012b); Bashir, *et al*. (2014); Bashir, *et al*. (2007)]. While focusing landless households of rural Punjab, Bashir *et al*. (2012) found that 27 percent of them are food insecure. They evaluated food security status by comparing calorie intake via seven day recall method with a threshold level defined by the GoP for rural areas i.e. 2450 Kcal/capita/day [Pakistan (2003)]. In another study Bashir, *et al.* (2012) found that 6.5 percent and 23 percent rural households of Punjab are food insecure based on 1770kcal/day/person and 2450 Kcal/day/person thresholds respectively. Bashir, *et al*. (2012) also investigated rural household food security specifically for three regions (South, North and Central Punjab) of the Punjab. Results revealed that Central Punjab was more food insecure with 31 percent of food insecure households in the sample. While In South Punjab and North Punjab 13.5 percent and 15 percent households were food insecure respectively. Moreover, Asghar and Muhammad (2013) used PSLM (2007-08) survey data and following FAO (1996) guidelines, calculated minimum daily required calories for each household considering age-sex composition of household members.

Study found 50.4 percent households are food insecure. Incidence of food insecurity is less i.e. 39.5 percent among farmer households and greater among urban households (52 percent urban and 48 percent rural). Sindh province (60 percent) is found to be most food insecure in this study. Asghar (2011) using HIES (2007-08) data and 2250 per adult equivalent/day threshold, report similar patterns of food insecurity in Pakistan i.e. 35 percent food insecure in Pakistan with Sindh (48 percent) being most and KPK (23 percent) least food insecure. Urban food insecurity is higher (40 percent) than rural (34 percent).

Additionally, research about consumption patterns in Pakistan is dominated by estimation of different demand systems for alternative food and non-food commodities [Mukhtar (1985); Ahmad and Ludlow (1987); Ahmad, *et al.* (1988); Ali (1985); Alderman (1988); Burki (1997)]. However, Pakistan most of the studies about food demand and food insecurity are based on cross-section data sets i.e. households surveys of Pakistan [Hayat, *et al.* (2016)]. Use of time series for above mentioned objective is rare. Burki (1997) used annual time series disappearance data of Pakistan from 1972-73 to 1991-92 and estimated food preferences of consumers. This study observed food consumption trends of selected food commodities have changed during study period. Study reports that consumption of meat is increasing and of lentils (gram and mung) is decreasing.

From literature search mostly we find cross-section evidences in different dimensions of food insecurity related to Pakistan. Some studies have analysed supply side (food availability) of food security overtime for Pakistan [see for instance Ahmad (2009) and Ahmad, *et al.* (2015)]. For Pakistan, to our knowledge, none of the studies have performed food insecurity analysis over time from demand/access to food or consumption side. Government of Pakistan has been conducting household income and expenditure surveys for quite a long e.g. HIES since 1963. Though nationally representative household panel surveys are not available, these independent cross-sections can help in monitoring food insecurity trends overtime in Pakistan. This study attempts to fill this literature gap.

3. METHODOLOGY AND DATA

There are different measures of food insecurity that are used in the literature. Table 1 presents a broad classification of food insecurity measures with their advantages and disadvantages.

3.1. Measurement of Food Insecurity at Household Level

In accordance with the objectives, Household Expenditure Survey (HES hereafter) method is used in this study to measure food security level of households. HES contain information about food quantities and expenditures. For food items acquired/consumed at home both quantity and expenditures are

Table 1

Derived and Fundamental Food Insecurity Measures

Method	Principles	Advantages	Disadvantages	Current study
Derived Measures				
FAO method	Outcome: national calories available per capita per day or calories consumption per capital per day - Inputs: food balance sheets, energy intake coefficient of variation, single cut-off point to estimate at-risk population -Inputs: alternative to FBS recently HES and DHS data are also being used	Inexpensive -Applied worldwide on annual basis when based on FBS	Does not identify at-risk households or individuals -Dietary quality not taken into account - High measurement error -Low standardisation on data collection methods across countries - Evidence-base of cut-off point is questionable -When based on HES data they are not available for all countries of same quality	Not using, Reason: Focus is identification of FI households and to see economic access to food and its trends. It does not identify FI households rather tells proportion of FI population only.
Household Expenditure Surveys	Outcomes: caloric intake per capita per household, dietary variety score - Inputs: food quantities and expenditures, reference period, food composition tables to convert food expenditures and consumption into energy intake	Identifies vulnerable households - Can take into account dietary quality - Used for evaluating national poverty reduction and other assistance programmes	Measures food available but not necessarily consumed during period of interest (periodicity bias) - Difficult to estimate foods consumed outside the household, fed to animals, exchanged as gifts or payment of work or wasted - Difficult to standardise methodology across countries - Expensive and logistically difficult - Data usually not available annually	Using this, Reason: Satisfy objectives of study and HES data availability over the years
Dietary intake	Outcomes: Individual's food group intake counts, nutrient intake, Inputs: 24-hour recalls, FFQ, food records, food composition tables, known nutrient requirements, reference period	Measures actual food consumption - Can assess short medium and long term food intake - Deals with both dietary quality and quantity - Identifies at-risk households and individuals	Memory "recall" bias - High intra-subject variability in food and nutrient intakes - Difficult to assess portion sizes - Food composition tables need to be of high quality and culturally appropriate - Uncertainty about human requirements for most nutrients - High cost especially for inclusion of 24-hour recalls in national surveys -National data unavailable annually	Not using, Reason: required data unavailable at national level. Study's objective is to see trends in FI at national and sub-national levels.
Anthropometry	Outcome: Percentage of population malnourished - Inputs: weight, height, age other body dimensions	Highly standardised - Evidence-based cut-off points - Inexpensive - Frequently Applied in national surveys	Nutritional status indicator - FI-obesity relationship difficult to interpret	Not using, Reason: MICS and PPHS contain data about anthropometric indicators but only for specific population group and region. Data availability is limited to few years. Trends cannot be observed for longer period due to data unavailability
Fundamental Measure				
Experience-based food insecurity scales	Outcome: Household level of food insecurity Inputs: scale containing items representing the conceptual and multidimensional nature of FI, algorithm to convert scale scores into FI categories	Fundamental measure of FI - HFSSM and adaptations valid across diverse socio- cultural settings - Captures the physical and psycho-emotional dimensions of FI - Low cost allowing for decentralisation	Does not capture food safety dimension - Different reference time periods and frequency response options needed in different settings - Difficult to standardise cut-off points across regions/countries -"Benefit" bias	not using, Reason: data not available over time. PPHS has some elements of this but only for 2010 for a small sample.

Source: Pérez-Escamilla and Segall-Corrêa (2008).

FFQ: food frequency questionnaire; FI: food insecurity; HES: Household expenditure survey; DHS: Demographic and health survey; FAO: Food and Agriculture Organisation.

reported while for food acquired/consumed away from home (FAFH) only food expenditure are reported in most countries including Pakistan. In this study food security status is identified based on dietary energy consumption (DEC hereafter, measured as tkcal/day/adult equivalent) at household level. Caloric values of food items are obtained from food composition table of Pakistan (FCT) [AIOU (2001); revised in 2001].

According to Moltedo, *et al.* (2014), the procedure to convert food quantities into kilo-calories (kcal) involve some complications in wake of certain data limitations in HES food consumption module. Some of them are listed below.

- Some food quantities are reported in non-standard local measurement units and the relevant conversion factor into standard measurement units is not reported (example ready-made foods, *chapatti, halwapuri* etc).
- Reported food quantities include both edible and non-edible quantities. But proportion of nonedible portion (like bones, peels, seeds, etc.) is not specified to find out edible portion only.
- Undefined food items such as dinner, lunch, meal, other readymade foods, beverages etc.
- Some food items are not available in national or regional FCT/FCDB available.
- Calculating nutrient values for local food items that are not well defined (like other cereals, other meat, others fruits or vegetables etc.) is not possible.

For these limitations Moltedo, *et al.* (2014) has proposed two procedures to calculate DEC. The first procedure is applied when food quantities are expressed in grams of EP and FCT contains kcal for the food items, while second is used when quantities of foods are either not available or not convertible to grams EP but food expenditures are available.

HES of Pakistan provides information for food items both consumed at home (quantity and money value) and away from home (only monetary value), in raw or processed form. It also has data limitations described above. Therefore, WB (2014) method is followed in this study and explained below.

3.1.1. Procedure I

For the items where food quantities are available, following steps are carried out to calculate DEC (tkcal) for households.

Step 1: Standardise food quantities into grams: To convert food quantities into grams, multiply the food quantities given in kilograms with 1000, in grams with 01 and so on. For quantities reported in litres we first convert them into

millilitres and then using their density values,[7] they are converted into grams based on following formula.

$$Q_{ih}(g) = Q_{ih}(ml) * density_i \left(\frac{g}{ml}\right) \qquad \dots \qquad \dots \qquad \dots \quad (1)$$

where 'i' represents food product with a valid density coefficient and 'h' represents household, 'g' represents grams and 'ml' millilitres.

Step 2: Adjust food quantities for refute factor or nonedible portion. Food quantities reported in HES include both edible and non-edible (peels, bones, seeds, etc.) quantities of food items acquired/consumed by households during reference period (14 days or 30 days). FCT contains kcal for edible portions only. Hence following formula is used to transform quantities into EP where required.[8]

$$EQ_{ih} = Q_{ih} * \left(1 - \frac{R_i}{100}\right) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (2)$$

Here, EQ_{ih} represents edible quantity, Q_{ih} represents the quantity of ith food item as acquired/consumed by 'h' household including nonedible portion. 'R_i' shows percentage of non-edible grams in ith food item. $\left(1 - \frac{R_i}{100}\right)$ also called edible coefficient shows the edible portion of food.

Step 3: Estimation of total calories (tkcal) per household. Food items for which valid EP and caloric values exist, tkcal are calculated using the following formula.

$$tkcal_{gh} = \sum_{i=1}^{g} \left(\frac{(EQ_i * Kcal_i)}{t}\right) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \quad (3)$$

Where; 'g' refers group of food items that are consumed/acquired by household and their quantity and expenditure is reported. EQ_i refers to edible food quantity and Kcal to caloric value of *i*th food item. In eq (3) ($EQ_i * Kcal_i$) represents DEC from *i*th food item which is then divided by '*t*' to convert it into daily DEC. Here, '*t*' shows reference period of food item acquired/consumed by household. To find out households' total daily DEC ($tkcal_{gh}$) from 'g' group daily calories are summed up across all the food items included in 'g'.

3.1.2. Procedure II

For food items in HES where only food expenditures are reported or their reported quantity is not convertible to grams EP, procedure II is explained below to calculate DEC. Calories are imputed from food expenditures using Equations

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[7]Density values for liquids or semi-liquids can be found in the FAO/INFOODS Density Database Version 2.0: http://www.fao.org/infoods/infoods/tables-and-databases/faoinfoods-atabases/en/.

[8]To convert amounts of total foods (including inedible part) to EP, see the FAO/INFOODS *Guidelines for Converting Units, Denominators and Expressions Version 1.0* (2012).

4–6. Assumption underlying this procedure is that calories consumed away from home cost on average the same as calories consumed at home. In Equation 4, household level price per calorie or calorie unit value is estimated by dividing each household's food expenditure on 'g' food items ($\sum_{i=1}^{g} FDEXP_i$) with their respective tkcal ($\sum_{i=1}^{g} tkcal_i$).

$$PPcal_h = \left(\frac{\sum_{i=1}^{g} FDEXP_i}{\sum_{i=1}^{g} tkcal_i} \right) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (4)$$

Then in order to reduce effect of measurement errors in HES and to account for quality differences across households median prices per calorie are calculated at province, region and decile level. Hence, we get 80 different average prices per calorie (4*2*10=80)[9] using below-mentioned equation.

$$PPcal_{prd} = median(PPcal_h) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (5)$$

Here, $'PPcal_{prd}'$ shows median price per calorie at province (p), region (r) and decile (d) level. We get unique price per calorie for each expenditure decile in urban and rural part of each province respectively. Afterwards, estimated median price per calorie is applied to expenditure incurred on food items where procedure I was not applicable (food items taken away from home or purchased as readymade foods, not well defined food items e.g. other category) using formula below. Here, 'k' represents food items where kcal could not be estimated following procedure 1. 't' shows the reference period of food item's acquisition/consumption reported in HES.

$$tkcal_{kh} = \sum_{i=1}^{k} \left(\frac{\left(\frac{FDEXP_i}{PPcal_{prd}} \right)}{t} \right) \qquad \dots \qquad \dots \qquad \dots \qquad \dots \qquad (6)$$

Here, $tkcal_{kh}$ shows daily DEC from FAFH or not well defined food items as explained above. For raw food items with missing quantities same method shall be adopted with per calorie price averaging at province, region and decile level for that food item. Then expenditure on such item is divided by respective price per calorie to get its kcal value.

3.2. Adjustment for Age-Sex Composition of Households

HES provide food consumption data at household level only. Dietary energy requirements depend on age and sex of person and thus, vary across households due to difference in their age-sex composition and size. To account for these differences, first each household's adult equivalent size is calculated using Equation 7. Wherein, each household member's adult equivalent size/factor (AE_i)[10] is taken from equivalence scale given in Poverty reduction

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[9] Four provinces, two regions, 10 expenditure deciles.

[10] Adult equivalent factor compares every individual's energy needs with that of an adult male with moderate activity [Smith and Subandoro (2007)].

strategy paper Pakistan [PRSP-I (2003)] that is reproduced in Table 2. Sum of individual's adult equivalence numbers at household level gives its adult equivalent size i.e. AE_h in Equation 7. It allows comparison of DEC across households while controlling for age-sex differences among households.

Moreover, in case intra household allocation of food is not as per individual requirement, it is quite possible that food secure households have food insecure individuals and vise-versa. Assuming that food is equitably distributed among household members, analysis in this study is performed at household level in wake of household level data availability only in HES.

$$AE_h = \sum_{i=1}^{hhsize} AE_i \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad (7)$$

Table 2

Adult Equivalence Scale

Age Bracket	Energy per Person Daily Requirement	Equivalent Factor
Children		
<1	1010	0.4297872
01-04	1304	0.554893617
05-09	1768	0.752340426
Males		
10-14	2816	1.198297872
15-19	3087	1.313617021
20-39	2760	1.174468085
40-49	2640	1.123404255
50-59	2460	1.046808511
60+	2146	0.913191489
Females		
10-14	2464	1.048510638
15-19	2322	0.988085106
20-39	2080	0.885106383
40-49	1976	0.840851064
50-59	1872	0.796595745
60+	1632	0.694468085
National Average	2350	1

Source: PRSP-I (2003).

3.3. Calculation of Total Daily Dietary Energy Consumption Per Adult Equivalent

Total daily per adult equivalent DEC ($DAEtkcal_h$) at household level is calculated by dividing the sum of calories obtained from procedure I and II above by adult equivalent size of respective household in Equation 8 below.

$$DAEtkcal_h = \frac{tkcal_h}{AE_h} = \left(\frac{(tkcal_{gh} + tkcal_{kh})}{AE_h}\right) \qquad \ldots \qquad \ldots \qquad \ldots \qquad (8)$$

3.4. Food Security Status of Households

Now in order to decide whether a household is food secure or insecure, households' $DAEtkcal_h$ is compared with their minimum dietary energy requirement (MDER). For this purpose FAO (2017)[11] recommended MDER is used in this study after converting it into adult equivalent terms. As shown in equation 9, $'FI_h'$ shows food insecurity status of households and it equals one for food insecure households and zero for food secure.

$$FI_h = \begin{cases} 1; \text{ if DAEtkcal}_h < MDER \\ 0; if \text{ DAEtkcal}_h \geq MDER \end{cases} \quad \cdots \qquad \cdots \qquad \cdots \qquad \cdots \qquad (9)$$

Afterwards, proportion of food insecure households is calculated at national, provincial and regional level in order to produce region-wise trends in incidence of food insecurity.

3.4.1. Minimum Dietary Energy Requirement (MDER)

According to FAO (2008) MDER is the amount of minimum energy that a person requires to satisfy energy needs for minimum acceptable weight for attained-height, maintaining a healthy life and carrying out a sedentary physical activity level. In the entire population, the MDER is the weighted average of the MDERs of the different sex and age groups in the population. It is assumed that when a household is unable to meet its MDER, it is unable to maintain health, body weight required to engage in light activity or body at rest position. If individuals DEC is below MDER heath issues start due caloric deficiency. Hence, this deficiency further results in physical and mental impairment and low labour productivity [Bagriansky (2017)]. During 2016 latest MDER as recommended by FAO is 1772 kcal per capita per day for Pakistan. To convert this per capita requirement into per adult equivalent following formula is used.

$$MDER = \left(\frac{1772*N}{AE_{2015-16}}\right) = 1910 \qquad \cdots \qquad \cdots \qquad \cdots \qquad \cdots \qquad (10)$$

Here, 'N' represents total sample size of HIES 2015-16 and '$AE_{2015-16}$' shows sum of households' adult equivalent size from HIES 2015-16. It gives 1910 kcal. Hence, study will use 1910 kcal/day/adult equivalent as MDER in equation 9 to figure out households who are consuming lesser calories (food insecure) when compared to MDER.

3.5. Total Per Capita Expenditure Quintiles

To satisfy second objective of study, total expenditure is used as proxy of income. Households are categorised based on total per capita expenditure

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[11]http://www.fao.org/fileadmin/templates/ess/foodsecurity/Food_Security_Indicators.xlsx (accessed on 01, May, 2018)

quintiles. Then expenditure quintile-wise proportion of food insecure households and, hence, incidence of food insecurity is calculated for each round of HES used in this study and food insecurity trends in five quintiles are observed.

3.6. Data

Household Integrated Economic Survey (HIES)[12] data is used in this study for its seven rounds as listed in Table 3. Reason behind is that it is most regular national, province and region level representative household data set for Pakistan. Main outcome variables are food quantity acquired/consumed by households and food expenditures. DEC is primarily based on this variable and caloric values obtained from FCT (2001) of Pakistan. Other variables to control for household heterogeneity include age and gender of household members, per capita expenditure, region and province of residence of household. Following table presents sample layout for various issues of HIES conducted during 2004-16 that are used in the study.

Table 3

Sample Layout of HIES in Various Rounds

Years	Survey	Number of PSUs			Number of Households (SSUs)		
		Urban	Rural	Total	Urban	Rural	Total
2004-05	HIES	486	559	1045	5809	8899	14708
2005-06	HIES	531	578	1109	6240	9214	15454
2007-08	HIES	532	581	1113	6255	9257	15512
2010-11	HIES	564	616	1180	6589	9752	16341
2011-12	HIES	604	613	1217	7248	9808	17056
2013-14	HIES	628	833	1461	7006	12998	20004
2015-16	HIES	1087	518	1605	16155	8083	24238

Source: Various reports of HIES.[13]

4. RESULTS AND DISCUSSION

Since 2003 Pakistan has faced many natural shocks and manmade crises. Some of the major crisis that hit the country include disastrous earthquake in 2005, floods in 2010, 2011 and 2014, militant activities and military operations against them in north-western areas of country[14] displaced more than three million people[15], security problems in urban centres, energy crisis resulting into slow-down of economic activity and abandoning of general subsidies under the

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[12]by Pakistan Bureau of statistics.

[13]www.pbs.gov.pk/content/pakistan-social-and-living-standards-measurement.

[14]Khyeber Pakhtonnkhwa, FATA, Balochistan.

[15]Swat, Bunner, Dir, Shangla, Bajur, Mohmand, South Waziristan and Orakzai agency.

IMF standby facility. Directly or indirectly, all of these shocks and crisis have adversely affected the level of food security of households and altered the incidence of food insecurity in Pakistan [SDPI (2009)]. IFPRI (2017) report that though for overall Pakistan average daily caloric intake exceeds recommended threshold (2350 kcal per day per adult equivalent), its urban and rural poor hardly ends up with only 1,786 and 1,848 kcal respectively. Hence, with rural poverty rate of 55 percent, history of floods, earthquakes and droughts, country may get additions to its bulk of vulnerable, poor and food insecure population.
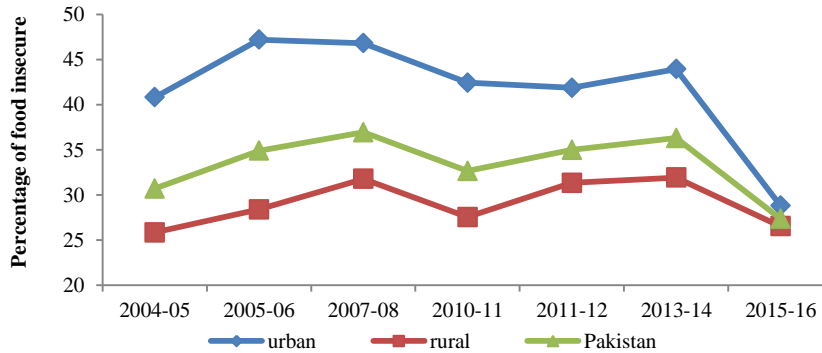
To find out food insecurity trends during 2004-16, percentage of households consuming below their minimum dietary energy requirements (1910 kcal/day/adult equivalent) is calculated for overall Pakistan, its rural/urban regions and four provinces.

4.1. Region Wise Trends of Food Insecurity During 2004-16

Figure 1 shows region wise trends of food insecurity during 2004-16 at FAO (2017) recommended minimum dietary energy requirement –MDER (1910 kcal/day/adult equivalent) adjusted for adult equivalents. Results show almost similar fluctuating trend of food insecurity in Pakistan and its rural/urban regions. Difference is in intercept mainly and the incidence of food insecurity (level) differs in three Pakistan and its regions. Food insecurity incidence is almost 30-37 percent in overall Pakistan with more pronounced food insecurity in urban region (29-47 percent or above) and slightly lesser in rural areas (26-32 percent) during entire study period except in 2015-16.

Study finds high incidence of food insecurity in Pakistan. More than one fourth of its population is unable to meet their MDER even in rural areas that are mostly agriculture based settings. Literature shows that despite increasing per capita dietary energy supply, average per capita caloric consumption is declining overtime in Pakistan [Ahmad and Farooq (2015)].

Fig. 1. Region Wise Trends of Food Insecurity During 2004-16 at 1910 kcal/day/adult Equivalent

As mentioned earlier, one contributing factor to high and increasing level of food insecurity found during 2005-08 is that Pakistan undergone disastrous earthquake in 2005. This earthquake badly affected northern Pakistan and Islamabad. According to government of Pakistan preliminary estimates,[16] in this earthquake almost 2.3 million were reported without access to adequate food [ADB and WB (2005)].[17] Loss of livelihood, food stocks and income due to earthquake might have turned many low wage workers' households (engaged in agriculture, local businesses and other local manual works) food insecure.

Moreover, poverty gap estimates for Pakistan in 2004-05 and 2005-06 show almost 75 percent population clusters around poverty line. This group is vulnerable to any shock causing small changes in income, crop output or food prices [Pakistan (2010)]. Food prices that were falling since 1960s around the world as a result of Green Revolution started increasing after 2000 and almost doubled in first decade of 21st century (FAO Food Price Index).[18] In 2007-08 in wake of a sharp increase in oil and primary products prices both in international and domestic markets, food price crisis reached its peak in Pakistan as well. It well known that food inflation disproportionately affects poor because food expenditures are usually major component in average household expenditures (50 percent or more). According to economic theory persistent increase in food prices tends to pressurises wages upward and, with a time lag general inflation as well. Thus, inflation in Pakistan turned double digit in 2007-08 with low economic growth in wake of energy crisis and industrial shut down and quasi-stagflation situation emerged [Pakistan (2007)]. Purchasing power of poor decreased by almost 50 percent [WB (2014)][19] and food security situation worsened. As evident from figure1, food insecurity is highest in Pakistan as well as its rural urban regions in 2008.

Prices of wheat and rice that are main staple foods in Pakistan faced ever higher inflation i.e. 62 percent and 73 percent respectively in 2008 [Pakistan (2009)]. Wheat is a major source of food energy for the poor peoples (almost 55 percent of their total caloric intake). Friedman, *et al.* (2011) reports that wheat price in Pakistan increased by 106 percent and for other staple food price increase ranges between 20 to 120 percent during 2005-08. While average prices of nonfood items increased 17 percent only. Task force on food security (2009) report indicates that share of food expenditure in total household expenditure increased from almost 50 percent to 70 percent in poor households. Consequently, six million more people fell below poverty line during this food

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[16]http://siteresources.worldbank.org/PAKISTANEXTN/Resources/Publications-and-Reports/ Damage-Assessment-Main.pdf

[17]almost 73000 people died, more than 70000 injured or disabled and more than 2.8 million people lost their homes.

[18]http://www.fao.org/worldfoodsituation/foodpricesindex/en/

[19]Pakistan: country development landscape by The World Bank Pakistan 2014.

price hike [Pakistan (2009)]. In absence of similar wage growth it shows reduction in expenditure on non-food basic needs (health and education) in poor and food insecure households. These findings show Pakistan is not food secure mainly because of stagnant production and increasing imports that are powered by explosion of commodity prices in international markets.

WFP (2009) also found that almost half of Pakistan's population was food insecure in 2008 as its daily per capita caloric intake was less than MDER i.e. 1700 kcal. Prominent reason is dominant share of wheat in households' calories intake and food expenditures in Pakistan [FSA (2009) and Pakistan (2009)]. These findings are consistent with literature as Friedman, *et al.* (2011) also found decline of eight percent in households' caloric availability during 2006-08. They report both poor and non-poor households need significantly greater food expenditures compared to pre-crisis level to maintain their consumption at previous level.

Interestingly Pakistan had bumper wheat crop in 2007-08 and large price differential compared to neighbouring countries in wheat. Price differential induced smuggling and domestic hoarding of wheat in the country resulted in 1.7 million tons of wheat import at a price above the one at which it exported wheat in same year. To discourage smuggling and hoarding government increased wheat procurement price and banned inter provincial/district movement of wheat without prior approval. As a result by 2009 domestic wheat price in Pakistan surpassed international wheat price [Pakistan (2008)] (almost 87 percent increase). This restriction on intra-country trade in wheat and high procurement prices of wheat in 2008-09 resulted in further decline in wheat consumption in particularly remote food deficit areas of the country [Ahmad and Farooq (2010)]. In Pakistan more than half of poor households are nonfarm, only 26 percent people/farmers produce wheat while 97 percent consume it. Hence, the surge in wheat price in 2008-09 turned many at risk of food insecurity food insecure.

Even rural area residents are not safe from adverse effects of food price crisis. Reason is that economic access to food is primarily determined by households' differences in land holding, employment and education in rural areas. Agriculture productivity and farm incomes have failed to catch up inflationary trend in economy because size of land holdings is declining besides inability of economy to generate new employment [Ahmad and Farooq (2010)]. Vulnerability of urban poor to food markets is well documented in literature. However, dependence and vulnerability of food insecure in rural areas who are mostly landless, small and marginal farmers is not well reported. Significant number of rural cultivators and landless households are net buyers of food [Staatz, *et al.* (2009)]. This justifies increase in rural food insecurity during 2007-08 food and fuel inflation. Own production buffers only landholders against outside shocks. In 2007-08 in wake of energy crisis costs of irrigation

using tube-wells and fertilisers also shoot up. Hence, small farmers, main players to ensure food security in a country, themselves suffered inflation and could not benefit from increasing food price [Woodrow Wilson (2011)].

To protect poor against inflation in general and food inflation in particular, government of Pakistan in its PRSP-I (prepared for 2004-08) and PRSP-II (prepared for 2008-11) made considerable pro-poor allocations. Here, 17 priority areas were selected in Medium term expenditure framework (MTEF) and allocation were made for different social safety nets. Programmes like BISP, Food support programme, school feeding programmes, food for work, to achieve MDG targets protected ultra-poor against inflation and natural disaster to some extent. Pro-poor allocations both by federal and provincial governments amounted to 7.6 percent of GDP in 2009-10 and were raised to 15.8 percent of GDP in 2010-11. In our results we find a downward trend in incidence of food insecurity during this period i.e. 2009-11.

Floods in 2010 damaged food production (wheat grain and seed stocks specifically), distorted livelihoods and established plot for even higher food prices due to supply reduction [Ahmad and Farooq (2015)]. Fortunately, food prices in international market were declining in this period and domestic food prices were above international food prices. Resultantly, exportable surplus was left unsold in stocks and was available for supply in domestic markets. Hence, the rich yield of 2009 and declining world food prices helped offset the impacts of floods in 2010 and protected wheat prices from further going up.

Unfortunately, poverty and food insecurity reduction gains from BISP, food support programmes and other social safety nets spanning over 2008-10 were reversed after floods in 2010, 2011 and 2014, militancy and resultant internal displacement of people. Hence, increase in food insecurity during 2011-12 is possibly an indication of compounded effects of 2010 and 2011 floods. In 2010 floods' devastations were huge with almost 20 million affectees. People were trying to recover from 2010 floods' damages when again in 2011 floods hit southern areas[20] of Pakistan affecting almost 9.6 million people. Wheat stocks were badly affected in 2010 floods. These floods damaged standing crops, food stocks, assets (livestock, houses and commercial buildings), and infrastructure (roads, bridges, markets, education and health facilities). Severely affected areas were already underdeveloped with critical levels of food insecurity and malnutrition [Pakistan (2011)]. State of social services was not promising even before floods in floods affected areas compared to unaffected areas in 2010. Damaged infrastructure and continued rains restricted aid and social service delivery in these areas.

According to Pakistan Economic Survey 2011-12, agriculture sector (crops, livestock, fisheries, poultry and on-farm water distribution) that occupies

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[20]All 23 districts of Sindh and adjoining areas of northern Balochistan.

considerable employment share particularly in rural areas, was most affected following housing, education, financial, private sector and industries. Crops subsector share 91.5 percent losses[21] with damages to cultivated land area under cotton (74 percent), rice (33 percent) sugarcane (34 percent), vegetables (79 percent) and fruits (32 percent). These floods displaced many people (744,000 in 2011 floods). United Nation office for the Coordination of Humanitarian Affairs (UN OCHA) reported that failure to cultivate Rabi crops would affect many farm dependent households adversely. This situation added to food insecurity in Pakistan both at national and sub-national level. Resultantly, in figure1 trend reversal is observed during 2011-14.

Government, national and international NGOs, international donor agencies and civil society protected disaster victims against adverse effects of floods by provision of tents, medical camps, ration packs and direct cash transfers (provincial government of Sindh with support from federal government disbursed almost Rs.10.3 billion through the Pakistan Card-based cash transfer scheme (Rs.10,000 per family). In December 2011 in response to appeal of government of Pakistan 46 countries pledged US$260 million (including both cash and in-kind support). United Nations (UN) launched a US$ 356 million Rapid Response Plan in September 2011 and the Early Recovery Framework worth US$ 439 million in January 2012 to carry on flood response activities until September 2012 [Pakistan (2011)]. Ensuring food security for victims was prime concern in all of these relief activities. As a result study finds that number of food insecure in Pakistan and its rural region specifically, increases at decreasing rate in 2011-14.

World again witnessed food price hike (more than 30 percent annual increase) between March 2010 and March 2011. According to Pakistan economic survey of 2010-11, large price increases for items like cereals, meat and edible oils to which poor are very sensitive underpinned this price hike. In part it triggered from production shortfalls resulting from extreme weather, cyclical and structural factors. These factors reduced real incomes of rural poor. Rising and volatile trend in food prices persisted in short run due to falling grain carryover stocks because of mismatch between current production and consumption requirements and weather disturbances induced supply uncertainties. This food inflation decreased purchasing power of the poor and eroded much of the gains from adoption of poverty reduction strategies during first decade of 21st century [Pakistan (2010)]. and added to the number of food insecure during 2010-13.

However, natural disasters and militancy induced displacements have lingering long term effects while relief packages provide short term protection.

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[21]Includes estimated losses to crops of Kharif 2011, food and seed stocks; on-farm irrigation water facilities; and support services for crops and indirect losses to forthcoming Rabi 2011-12 and Kharif 2012 crops.

Loss of livelihood sources and essential infrastructure push already poor and vulnerable groups behind further and turn many at risk of food insecurity into food insecure. Thus, a mild increase in food insecurity is observed in 2013-14 as well and it is quite rational finding. In this year many initiatives aimed at reduction in food insecurity were taken. They include joining Scaling up Nutrition movement, drafting of National Food and Nutrition policy in Agriculture sector, National Zero Hunger Programme with joint collaboration among public sector and UN agencies, Child support programme. All of these programmes are providing in cash or in kind assistance to vulnerable and hence cutting on food insecurity.

Again in September 2014 floods affected Azad Jammu and Kashmir (AJ&K) and Punjab in Pakistan. Heavy rains also caused landslides in Gilgit-Baltistan (GB) at enormous scale. This time floods affected almost 2.5 million people, 1.0 million acres of cropland and 250,000 farmers. Effects of this flood didn't affect food security situation in 2013-14. As HIES data collection is spread across last two quarters of previous year (2013) and first two quarters of next year (2014). So effects of floods in 2014 didn't influence our estimates. Assets and income losses might have affected food security status of households in 2015-16. Due to one year time lag it is expected that they are not significantly affecting food security of households in our analysis. As shown in Figure 1, food insecurity has considerably declined in 2015-16.

We observe decline in food insecurity after 2014. Poverty incidence is also declining in this period in Pakistan for number of reasons. Factors that reduce poverty also curtail food insecurity. Among others it include an increase in allocation of social safety nets programmes like BISP, PPAF, improvements in support prices of agriculture products that reduced consumption based poverty headcount in rural Pakistan, high yield varieties of seeds, increased flow of remittances owing to improvements in manpower export policies, subsidies to consumers and producers [Pakistan (2013)].

Another important observation is urban households are affected more compared to rural counterparts [Friedman, *et al.* (2011); SDPI, SDC and WFP (2009)]. This is evident from our analysis as well. Incidence of food insecurity is considerably high in urban areas compared to rural areas. The difference in food insecurity between urban and rural regions is higher during 2004-11 compared to 2012-16. Poverty literature suggests use of different MDER for rural and urban regions to account for the differences in their living styles and employment nature. MDER are set higher for rural than urban areas because mostly rural population is involved in heavy manual works (agriculture is dominant employment) and have more active life styles [see for instance, Pronob Sen (2005) Ahmad and Farooq (2010)]. FAO recommends MDER for sedentary life style only and hence reports same MDER for both rural and urban regions. It is possible that consuming lesser calories is habitual/usual

consumption pattern of urban consumers. Light activities dominate urban work and living patterns. Use of same MDER can be a possible reason for overestimation of urban food insecurity and underestimation of rural food insecurity in present study.

Another explanation is that consumption basket is changing overtime. The dynamic nature of consumption basket is becoming more prominent in urban areas due to rapidly changing life styles and cost of living [Asghar (2011)]. Technological exposure and greater variability in weather has altered consumer preferences as well. With greater social awareness, people have to devote reasonable amount of income on education of their children and utility bills. Incomes are not growing on the same rate as expenditures, hence, urban population either shift expenditures from food to non-food purposes or substitutes between high and low value calorie sources [SDPI (2009); Sen (2005); Asghar (2011)]. In extreme cases people cut on the number of meals to meet non-food necessities (e.g. housing and education though basic needs but are too expensive in urban areas).

Results showing differences in incidence of food insecurity in rural urban regions are consistent with the literature. For example, Friedman, *et al.* (2011) while analysing welfare impacts of food price crisis of 2007-08 for different groups in Pakistan found that rural households are more resilient towards food price changes. They have greater protective capacity due to higher share of own produced food in their food consumption. Ability to produce food helps them maintain their calories intake above MDER in periods of rising food prices. Ironically, in 2007-08 food price crisis underpinned fuel and financial crisis. As mentioned above it left even farm households helpless to protect their incomes and food security status in wake of high input prices [Khan and Shah (2011)].

Another reason could be that cost of meeting MDER has increased more in urban areas than in rural areas. Overtime inclusion of readymade food into our food bundle has also increased food expenditures. Due to easy and quick availability of readymade food, consumption of food away from home is also higher in cities compared to rural areas. People prefer readymade food also because of their preferences for taste. Doing so they trade expensive but lower nutritious food for homemade cheaper and more nutritious food. Food consumed away from home has not been precisely captured in earlier issues of HIES. We have imputed caloric values for this component of food from its food expenditures and, hence, it can create bias in our estimates of food insecurity. Part of consumption module about food away from home (FAFH hereafter) has undergone changes over time so it is not precisely comparable. Particularly in recent issue of HIES (2015-16) a detailed section about FAFH or readymade food is added. With this acknowledgement of FAFH, we observe considerable decline in food insecurity during 2015-16 in all cases. Results show a sharp decline of 8 percent in food insecurity in Pakistan during 2012-16. From this decline it can be inferred that food consumption has been under reported in

HIES in part due to absence of detailed FAFH module in questionnaire. This partially explains the importance of revising food consumption module of HIES to include readymade food or FAFH.
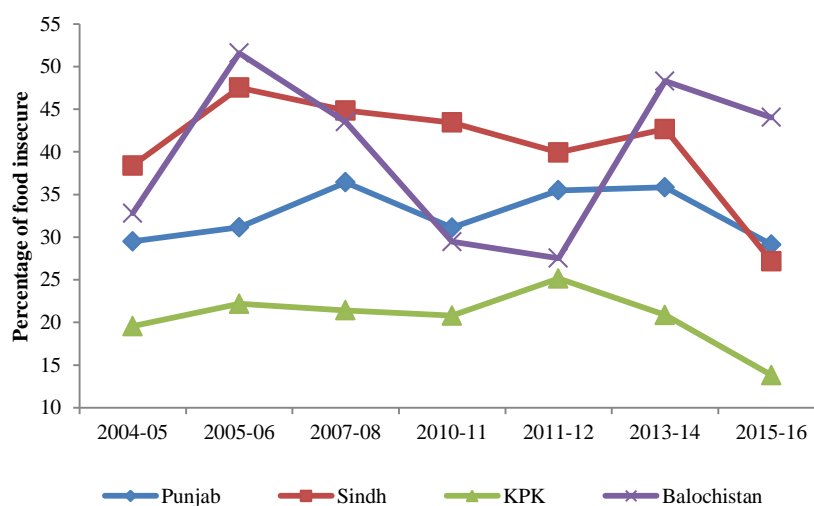
Amongst others, Ahmad and Farooq (2010) count rapid urbanisation, population growth and slower growth of cultivated area and agricultural productivity as responsible factors for high and increasing burden of food insecurity in overall Pakistan generally and urban areas specifically.

In short, vast scale social disruption caused from earthquake of 2005, intensified war against terror since 2007, and largest floods in living memory of 2010 and then in 2011, and persistent food price hikes between 2007-11 combined with slow economic growth (an episode of quasi-stagflation) has grave ramifications for poverty, human development, food insecurity and income distribution in Pakistan [Pakistan (2010); Friedman, *et al.* (2011); WB (2014)]. These natural and economic shocks slowed down Pakistan's progress towards achievement of food security and eradication of poverty related MDGs among others.

4.2. Province Wise Trends of Food Insecurity During 2004-16

Figure 2 explains provincial trends of food insecurity. Level of development is very different in four provinces with Punjab being most and Balochistan least developed province. These development differences are evident in food insecurity trends as well. Considerable differences in prevalence of food insecurity across four provinces are found. Otherwise Most of the time provinces follow the trend in food insecurity found at national level.

Fig. 2. Province Wise Trends of Food Insecurity During 2004-16 at 1910 kcal/day/adult Equivalent

KPK has lowest percentage of food insecure population compared to other provinces during study period (2004-16). In Balochistan we find large fluctuations in food insecurity incidence. Though food insecurity rate is generally high in all provinces (40-75 percent at 2350 and 10-52 percent at 1910 kcal MDER), it is specifically high in Balochistan and Sindh. These results are in accordance with the findings of National Nutrition Survey (2011) and strategic review of food security and nutrition in Pakistan (2017) by IFPRI and AKU. Both of these documents report that the percentage of undernourished women and children is highest in Balochistan and Sindh and lowest in KPK.

Food insecurity is amongst acute forms of poverty when we measure poverty using minimum caloric requirement per capita [Dubois (2003)]. When we look at poverty statistics by Pakistan (2016a), it shows high rate of multidimensional poverty in Balochistan particularly in FATA (72 percent) that further compounds issue of food insecurity in Balochistan by limiting households' economic access to food.

SDPI, SDC and WFP (2009) reports increase in number of food insecure districts in 2009 compared to 2003. It shows number of food insecure districts in Punjab doubled, only eight districts were food secure in 2009 in Sindh and no district was left food secure in KPK and Balochistan in 2009 when compared to 2003 food security analysis findings. For Punjab and Sindh our findings are consistent with SDPI, SDC and WFP (2009). Our results contradict with it for Balochistan and KPK. We can see stability in incidence of food insecurity in KPK during this period. In Balochistan food insecurity does increased in 2004-06 but it declined afterwards till 2011. One reason for this adverse shift in food security in Punjab is worst hit of it from power crisis during this period. Punjab hosts large number of local industrial units and is also considered bread basket of the country. This crisis increased food insecurity in the province by hampering production costs, decreasing industrial output, employment and hence, households income.

During this period extremists' activities and military operations against them were in place in KPK and Balochistan. This depleted sources of livelihoods and adversely affected people's ability to access food. Conflict in militants affected areas displaced many people and added to probability of higher food insecurity [FAO (2017)]. However, not all of these high security risk areas were surveyed by PBS in each of HIES issue included in study. So, bias can result from this data limitation. WFP (2009) based on a survey conducted in 2008, also show KPK was the most food insecure province in 2008 but it is not the case in our estimates.

In rural areas of Pakistan specifically SDPI, SDC and WFP (2009) suggest that economic access to food at household level is primarily determined by the differences in education, land holding and employment. Literature suggests significant provincial variation in these indicators in Pakistan. Land holding in Sindh

and Balochistan is comparatively more skewed than Punjab and KPK. Literacy rate particularly female literacy rate (an important determinant of food security) is lowest in Balochistan. Due to poor agriculture landscape and under developed physical infrastructure employment opportunities are also insufficient in Balochistan. All of these factors add to its vulnerability to food insecurity more compared to other provinces of Pakistan. When we look at its trend we see huge ups and downs in incidence of food insecurity.
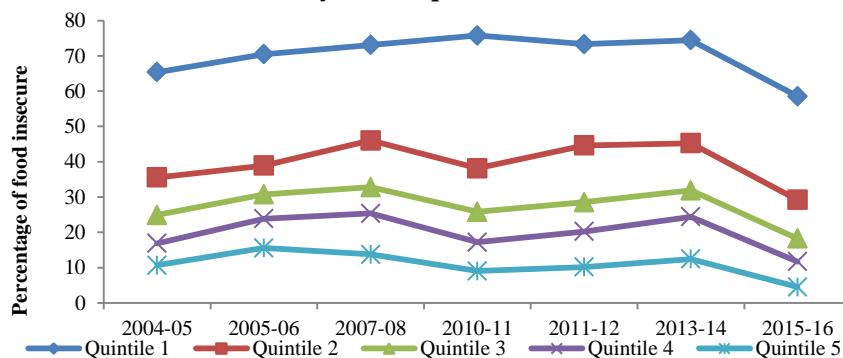
To curtail adverse effects of food inflation during 2008 along with national social security or safety nets programmes we find food support programmes launched by provincial government in Punjab only. However, MoPD&R, (2009) report on food insecurity highlights deficiencies in identification process of these schemes. One major drawback is usage of CNIC for identification of food insecure when large number of poor illiterate people in the country doesn't hold a valid CNIC. Hence these people are missed from these food support programmes as well [MoPD&R (2009)]. From here we can infer that degree of benefit from these safety nets depend upon literacy situation in provinces. Here again Punjab has advantage over other provinces. So, no considerable decline is observed in food insecurity in KPK and Sindh as a result of these programmes during 2006-10.

According to literature tribal system, law and order situation, low literacy rate, inadequate infrastructure, lack of technical knowledge and traditional practices and other factors such as being conflict zones most of the time result in higher incidence of food insecurity in KPK and Balochistan.

4.3. Per Capita Expenditure Quintile Wise Food Insecurity Trends During 2004-16

Economic accessibility is an important dimension of food insecurity and is primarily determined by households' income. In this study households' total expenditures are used as proxy of income. Figure 3 shows quintile wise trends of food insecurity during 2004-16.

Fig. 3. Quantile Wise Trends of Food Insecurity During 2004-16 at 1910 kcal/day/adult Equivalent

Results show incidence of food insecurity is high and stable in bottom quintile. More than 70 percent population is food insecure during study period except in 2005 and 2016. This situation is alarming as hunger impairs child growth and adversely affects human capital and labour productivity. On one hand it is an outcome of poverty trap and a cause to it on the other hand. These consequences of food insecurity reinforce poverty for generations and the poorest quintile is pushed into poverty trap. This stable trend in food insecurity we can say validates poverty trap situation for this income class.

Moreover, low literacy rates in poorest of the poor show their inability to benefit fully from public support programmes like BISP as mentioned above in wake of their identification strategies. More than 90 percent in this group cannot afford 2350 kcal/day/adult equivalent. No significant change in food insecurity for this group may be an indication of substitution between food and non-food basic needs in inflationary periods. Like MoPD&R (2009) reports that food expenditures ranges between 50–70 percent of total expenditures in this income group usually and this share increased further as a result of food inflation during 2007-08. Only wheat expenditures are 15 percent of their total budget. Consequently, when staple foods (wheat and rice) prices rise, they are to cut back on other social indicators' expenses like health and education.

It is also possible that they get protected from social safety nets programmes in times of crisis. In order to maintain school enrolments WFP (2009) initiated school food programme and distributed ration from girls primary schools platform to retain enrolments and promote girls education in KPK, Balochistan and Sindh.

However, for second and third quintiles trend of food insecurity is more fluctuating during 2004-16. It is perhaps in wake of their ineligibility for social safety nets and at same time high vulnerability to income or price shocks.

Even the richest quintile is not completely food secure. The incidence of food insecurity is 10 percent or more in this group except in 2015-16. A possible reason could be miss-reporting of consumption expenditures as usually the kitchen manager and household head are different in this income group. Kitchen managers are usually maids and often the person responding to enumerator is different from the one who does grocery in the household or manages kitchen. This finding may be acceptable on grounds that it may reflect differences in dietary preferences and needs due to comfortable work schedules.

Expenditures on readymade foods are significant in higher income quintiles. Unfortunately, apart from 2015-16 issue of HIES, no detail information is available on this food group. Considerable decline in food insecurity in richer quantiles during 2015-16 is an indication of this under-reporting of food expenditures. It calls for the need to improve HIES questionnaire. The gap between different quintiles is constant over time. It shows Pakistan is unable to narrow down income inequality over time.

Study finds that income has been a binding constraint for bottom quintiles to meet their MDER. These results are consistent with the literature. Among others, studies like Bashir, *et al.* (2012), Friedman, *et al* (2011), Sindhu, *et al.* (2008), Onianwa and Wheelock (2006) and MoPD&R (2009) also found that increasing incomes can considerably help reduce prevalence of food insecurity in lower quintiles specifically.

5. CONCLUSION

Food security has emerged as an important issue in recent years particularly after world food price crisis in first decade of 21st century. It has attracted global attention both in academic and policy circles after its prioritisation first in MDGs and now in SDGs. According to FAO (2017) number of undernourished people has increased in the world during 2016. Developing countries particularly host majority of this undernourished population (largest number lives in South Asia). Food security situation in Pakistan as well has rung alarm bells as reported in FAO (2016). It has shown worst performance after Afghanistan in reducing undernourishment during 2011-15 (–3 percent) in South-east Asia. Incidence of food insecurity and stunting, wasting in under five years age children is reported more than 50 percent in literature [WFP (2009); Pakistan (2017); WFP and Pakistan (2016)]. From long term perspective, malnutrition, a later outcome of chronic food insecurity annually costs Pakistan almost 3 percent of its GDP in form of lost productivity. It is a huge cost for a developing country. So, this issue is of grave concern in Pakistan.

Moreover, after 9/11 Pakistan has been targeted by extremists being an ally in anti-terrorist activities. Hence, it has faced both conflict and natural shocks during 2004-16. This situation exacerbates Pakistan's vulnerability to food insecurity. Moreover, availability of food is most explored food security dimension in Pakistan. While access to food a serious concern in resource scarce developing countries is not well explored particularly across time in Pakistan. Though cross section evidences are available about access dimension of food insecurity in Pakistan, to my knowledge, they are not comparable and do not tell anything concrete about trends in incidence of food insecurity.

To fill this literature gap, this study intends to measure and analyse region-wise trends in incidence of food insecurity in Pakistan during this conflict, natural and food price crisis period i.e. 2004-16. It also attempts to investigate role of economic status of households in incidence of food insecurity at household level during 2004-16. Household Integrated Economic Survey (HIES) data is used in this study from its seven rounds conducted during 2004-16.

Study finds that incidence of food insecurity is almost above 30 percent during analysis period except in 2015-16. Level of food insecurity is

considerably different in rural (less) compared to urban (high) region. Trends of food insecurity in rural and urban regions show similar fluctuations as observed in national level trends. Food insecurity trend is increasing during 2004-08, declining in between 2009-11 and again increasing in 2011-14. A sharp decline in incidence of food insecurity is observed in all regions during 2015-16.

Provincial trends in incidence of food insecurity are considerably different from each other and reasonably show developmental differences. At province level lowest and stable incidence of food insecurity is found in KPK. High incidence of food insecurity is found in Sindh and Balochistan. Very sharp fluctuations in Balochistan's trend specifically are observed. It is implied that food price crisis in 2007-08 and then in 2011 adversely affected food security at national and regional levels. Social safety nets like BISP, food support and subsidy schemes both by national and international organisations and pro-poor allocation in pursuance of poverty reduction strategies helped in mitigating adverse effects of price and natural shocks but consecutive floods in 2010 and 2011 reversed gains in poverty reduction and, hence, food insecurity.

It is also found that incidence of food insecurity is highest among poorest expenditure quintile but it is relatively stable against these price and natural shocks. Perhaps this quintile is covered in social safety nets programmes that help in offsetting negative effects of shocks. Most vulnerable to shocks is second quintile as shown by fluctuations in trend of food insecurity at point of shocks. It is also observed that exclusion of readymade food and food away from home increases incidence of food insecurity in richer quintiles while have no effect on poorest quintile level and trend of food insecurity. It indicates that unless data on this type of food items are not appropriately acknowledged and monitored in HIES, food insecurity incidence would be over-estimated and food expenditure under-reported for richer quintiles.

In a nut-shell, study found considerably high and unstable incidence of food insecurity at regional as well as national level in Pakistan.

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