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Status of Population Growth and Food Sustainability in Pakistan

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Abstract

Background/Objective: The study was attempted to investigate the status and growth performance of population and food supply in Pakistan, during 1997-2016. Methods/Statistical Analyses: The data were collected from secondary sources, like Economic Survey of Pakistan, State Bank of Pakistan and Food and Agriculture Organization. The study work was conducted on twenty years of data on country's population and food availability (rice, wheat, maize, sugarcane, bajra/millet, jawar/sorghum, rapeseed and mustard, gram, and barley), while determining the magnitude of their growth rate. Findings: The results show that overall population growth has been declining during 1997-16; but the female population growth was higher than male. On the other hands, the results further reveal that the Maize and Sugarcane crops had positive growth, where Rice, Jawar, and Bajra had lower growth performance during the time period. On average rice was grown by 5 percent in the country, while in last five years period (2012-16) its production declined by -0.25 percent, which might be due to the effect of climatic change. Although the wheat crop in last 10 year has a positive growth rate of about 2 percent. It was also estimated that food grains have been increasing almost at the same rate as the population is growing in the country. Applications/Improvements: In order to avoid or prevent forthcoming food conflicts in the country. It is suggested that government has to introduce new technology; efficient use of irrigation; agriculture credit provision; and sustainable agriculture practices, this all will support to increase the food production.

Keywords: Food Security, Governance, Pakistan, Population

1. Introduction

At present Pakistan is a sixth most populous country in the world with projected population of 203 million. According to World Population Data Sheet 2016, Pakistan with population of 344 million in 2050 is estimated to make it 6th largest country. Where the population growth rate in Pakistan is 1.89 percent, which is higher than average growth rate of South Asian countries. In fact, Pakistan is a low income developing country, where agriculture is its most important sector due to its primary commitment of providing healthy food for its fast growing population[1,2]. Normally, the population growth rate is an important indicator used to describe the change in population and play an important focal point in the economic development of a country. Rapid population growth may lead

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towards food conflicts, where food insecurity is a state or condition which may create malnutrition or insufficient availability of food to the population[3]. Moreover, it might generate environment problems and urban congestion[4]. Where it can also be the major factor behind the international migration[5].

As regards the land resources in Pakistan, the total cultivated area has increased by just 40 percent during the past 60 years, while there was more than 4 times growth in population with urban expansion of over seven fold, resulting into mega-cities as well as growing population pressure on cultivated land[6]. However, a commonly-used definition stemming from the 1996 World Food Summit states that food security is met when "all people, at all times, have physical and economic access to sufficient, safe, and healthy food to meet their dietary needs and food preferences for an active and healthy life". This definition created on the key work by[7]. In which he demonstrated that scarcity occurs not only from a lack of food, but from inequalities created into mechanisms for distributing food. So, not only does the definition bring in a wide range of problems related to a fuller understanding of food security, but some key words such as "food production" and "agriculture" – which might have been estimated in such a definition – are not included; the importance different from increasing food production by increasing access to food for all[8,9].

However, there is lot of literature available on both issues, e.g. food insecurity and population growth, where[10] have indicated that there is a need of a study which develops an alternative policy situation which are consistent with the target of food security in Pakistan. Thus, through this research aimed to see the magnitude of population growth and food sustainability in Pakistani context, to recommend tremendous efforts (policy measures) that how to narrow the gap between population growth and food production. Therefore, it is hypothesized that growing population may explode food conflicts in the country. That is why this wasbeing proposed to investigate and evaluate that what are the magnitudes of the current growth trends of the population and the food crop production (availability) in the country. Thus, for this study the following specific objectives were designed, to document Pakistan's population and food availability of the last 20 years to estimate and relate the twin growth performances (population and food) in the country since 1997-2016 and to envisage projections for policy makers to ensure the food security in Pakistan.

2. Materials and Methods

This section intends to present the methodological framework adopted for this research, where the annual time series data on population and food crop production were used for last 20 years (1997-2016). Furthermore, data sources and analytical techniques are also described in this chapter. The details on methodological considerations are provided in the subsequent sub-sections.

2.1 Data Description

The methodology of any study is based on the critical review of published and un-published literature within the domain. Thus, for present research data were collected from secondary sources, such as Pakistan Economic Survey, State Bank of Pakistan (SBP), Food and Agriculture Organization (FAO) and from other sources. The study work was conducted on twenty years of data on country's population and food availability (rice, wheat, maize, sugarcane, bajra/millet, jawar/sorghum, rapeseed and mustard, gram, and barley), while determining the magnitude of their growth rate. The food crops are mostly grown in two seasons, i.e. Kharif and Rabi. The Kharif season food crops are Rice, Maize, and Sugarcane, Bajra/Millet, Jawar/Sorghum, while the Rabi season food crops are Wheat, Barley, Gram, Rape & Mustard and Total Food Grain.

2.2 Model Specification

Growth rate is normally defined as the value added by which a quantity increases (or decreases) over time. Growth rates are commonly used as summaries of trends in time series data, where productivity indices, price indi-

ces and output indices are usually discussed in terms of the changing growth over various periods of time[11] have described that growth rates are measures of past performance of economic variables which are not developed to predict the trend in a variable over time. Normally the economic growth is expressed in percentage terms, implying the exponential growth. It is basically the application mathematical models in allied sciences, e.g. social sciences. Similarily, in[12] assert that measurement of trends and fluctuations should be of great interest for both the researchers and planners. In business and management point of view the annual percentage growth rates are useful when considering investment opportunities or to know the current trends of the outcomes in order to solve the basic economic question that how much to produce etc. Moreover, the policy decisions are often based on such a growth rate estimates. Therefore, the last 20 years data (since 1997 to 2016) on population and food crops were analyzed to estimate their growth rate by using the following models.

Growth rate model for one time period

$$AnGr = \frac{X_T - X_0}{X_0}$$

Growth rate model for more than one time period (average)

$$AvGr = \left(\frac{X_T}{X_0}\right)^{\frac{1}{T}} - 1$$

Where:

$AnGr$ = Annual growth rate

$AvGr$ = Average growth rate

X_o = Initial value of variable

X_T = Final value of variable

0 = Base year

T = Final year

Once data were collected, tabulated and analyzed by using MS Excel software, while the results are interpreted in the following section.

3. Results and Discussion

The section presents finding related to the current status of Pakistan's population and food crop performance, which is based on time series data of the last 20 years from (1997 to 2016). Thus, in this study the growth rates, annual and average of 20 years for population (male, female, rural and urban) as well as food crops produced in Kharif (Maize, Rice, Jowar/Sorghum, Bajra/Millet and Sugarcane) and in Rabi (Wheat, Barley, Gram, Rape & Mustard and Total Food Grain) are calculated. It was aimed to come-up with the suitable policy remedies for the food sustainability and population growth in Pakistan.

3.1 Pakistan's Population Performance during 1997-2016

In this subsection, the results regarding the population of Pakistan and the food availability have been presented. In fact, the data were collected from Pakistan Economic Survey and from different research journals. Thus, in this study the growth rates of Population and total Food production have been calculated by using the growth rate model, where the results are given in Table 1.

Table 1 shows the average five years population (male, female, rural and urban) growth rate in Pakistan, in which it can be seen that overall population growth has been declined since 1997-2016. Results shown that overall population growth has been declined during 1997 to 2016, may be due to the initiation of family planning programs in the country. Implementation of family planing is a good sign for human development in the country like Pakistan, which is under development process[13]. Similarly, male, female and rural population has also declined during the time, but one may look at urban population of each five years interval, it can be seen that during 1997-2001 it was more than 8 percent each year, there after it

Table 1. Five yearly population average growth rate in Pakistan (%)

Years / Particulars	1997-2001	2002-06	2007-11	2012-16
Male	1.84	1.72	1.70	1.6
Female	1.93	1.86	1.75	1.64
Rural	-0.65	1.6	1.14	1.09
Urban	8.68	2.16	1.79	2.5
Total Population	1.89	1.75	1.72	1.62

has declined as 2.16 percent for 2002-06, and 1.79 during 2007-11 and reached an average growth rate of 2.5 percent during 2012-16. Results show that the urban population is increasing at higher rate than rural one, it is may be due to rural urban migration. In fact it is commonly assumed that in the urban fringes about all basic amenities (such as; social security, power, sanitation, safe drinking water, medical services and educating) are available to local population. Furthermore, there is different values of social, economic and demographic aspects, that is why, the growth rate of urban regions is commonly expanding and the pace of general population increase[14,15].

3.2 Pakistan's Five Years Food Crop Growth Rate (Kharif & Rabi)

Agriculture is the backbone of Pakistan's economy, it contributes about 20.9 percent in the GDP, and provides livelihood to people directly involved in the sector along with the value adding chain. There are two cropping seasons in Pakistan, namely, Rabi and Kharif, Rabi crops grown normally in the months of November to April, Kharif Crops are grown from May to October. Pakistan's Kharif and Rabi food production average growth rate in five-yearly periods are analyzed and shown in Table

Table 2. Five yearly population average growth rate in Pakistan (%)

Year / Crop	1997-2001	2002-06	2007-11	2012-16
Maize	4.79	2.8	5.14	6.78
Rice	6.28	-1.22	6.71	-0.25
Sorghum/Jowar	-2.82	1.59	-2.37	5.03
Millet/Bajra	-1.35	11.9	8.93	0.54
Sugarcane	3.19	2.89	1.16	6.13

Table 3. Five yearly Rabi food crop average growth performance in Pakistan (%)

Year / Crop	1997-2001	2002-06	2007-11	2012-16
Wheat	0.99	-1.55	2.15	1.64
Barley	-3.53	-3.65	-2.28	-1.45
Gram	4.54	1.58	-3.11	-3.31
Rape & Mustard	4.03	-5.74	-1.52	3.69

2. Furthermore, the results in the above table indicates that during 1997-2001 the Maize increased by 4.79 percent, then it declined in the year 2002-06 it was 2.80 percent, then once more it increased in 2007-11 to was 5.14 percent, and again it has more than each five years increased by 6.78 percent, during 2012-16. According to Pakistan Economics Survey the maize production had positive growth rate of 6.9 percent and maize production increase due to the conversion of more area to Hybrid verities of seed and favorable weather condition that has an enhanced yield of the crops. It can be seen that during 1997-2001 the Rice was 6.28 percent after that it was dwindled in the year of 2002-06 which was negative -1.22 percent, and then increased by 6.71 percent during 2007-11, and by -0.25 percent decline during 2012-16. The results show that on average in last 20 years the rice grew by 5 percent in the country, while in last five years period (2012-16) its production declined by -0.25 percent. It is may be due to flood water during moon soon in 2010-11. According to literature[16] an area of 2.364 million hectares under Kharif Crops 2010 was damaged due to flood in Pakistan. During the outgoing year 2010-11, the overall performance of agriculture sector exhibited a weaker growth mainly due to negative growth of major Crops, which has washed up the rice belt in the country.

Results further show that during 1997-2001 average growth rate of Jowar was declined as negative -2.82 percent, thereafter it has increased by 1.59 percent of the year 2002-06, then was decreased as negative -2.37 percent in the year 2007-11, we observed that during 2012-16 it was more than 5.03 percent. It was further estimated that during 1997-2001 average growth rate of Bajra/Millet was negative -1.35 percent, it is seen that during 2002-06 it was other than much more in this five years increase 11.9 percent, there when it has declined as 8.93 percent for 2007-11, and also more less as 0.54 percent during 2012-16. The analysis in the table 2 also shows that during 1997-2001 the Sugarcane 3.19 percent after that the sugarcane growth rate was dwindled 2.89 percent; moreover, it was declined in 1.16 percent in the year 2007 to 2011, in the year 2012 to 16 it was increased up to 6.13 percent. The positive growth rate of sugarcane production was due to timely rains, judicious application of fertilizer, improvement in cultural practice, better management and attractive prices offered by the millers duringlast five years[17].

The results of the Kahrif crops expose that in general the Maize and Sugarcane crops had positive growth rates during 1997-2016, but when one look at other crops like Rice, Jawar/Sorghum and Bajra/Millet, which had not only lower growth performance during the time period, but in some times negative growth rates were also observed. This negative growth is might be due to high flood and increased temperature in the crop growing areas of the country[1]. The overall decline in agriculture sector has been recorded due to flood in the country,

especially largest damage in agriculture sector occurred in the decade of 1990's followed by 2000s[18]. Results of this study show that the production declined over time, in fact for nourishment of the growing population in the country, it is the main source of food[19] further he added that in Pakistan net annual requirement for a population including seed requirement is more than 21mmt besides unavoidable post production losses. The results further show that uppermost effects of climate change in terms of temperature rise, changes in rainfall pattern, and increased melting of glaciers and increased evaporation and increased irrigation water requirements. This food scarcity mostly due to low crop productivity due to irrigation water crisis[20] (Table 3). It was seen that during 1997-2001 the Wheat crop average growth rate was 0.99 percent, thereafter it was declined by -1.55 percent for 2002-06 was 2.15 once more it increased during 2007 to 11 and reached average growth rate 1.64 percent during 2012-16. This is also endorsed by[21,22], that the small farmers having lower production because they used to apply less weedicides, lodging, hailstorm in area, attack of aphids/rust, and heavy rain in March 2005 and poor managing their farms. Further, they have added that besides wheat, the other food crop performance in Rabi season is also ignorant, because almost all crops have very low level of production growth in the country, which is an alarming situation in the country, in order to feed the speedy growing population. When we look at the population growth which is more than 2 percent, while the wheat, which is considered as main or staple food diet grain crop, has lower growth performance in the country as compared to population growth. Thus situation can boost food insecurity in the country, if it has not been taken as priority by the agricultural policy makers.

Data show that during 1997-2001 Barley average growth rate -3.53 percent, thereafter it has declined as -3.65 percent for 2002-06, and -2.28 during 2007-11 and reached an average growth rate of -1.45 percent during 2012-16. We look at the Gram crop were its average growth rate during 1997-2001 was more than 4.54 percent each year, thereafter it has declined and becomes 1.58 percent for 2002-06, and negative -3.11 percent during 2007-11 and again reached an average growth rate of negative -3.31 percent during 2012-16. The results further show that Rape Seed and Mustard growth rate of each five years interval, we look that during 1997-2001 it was more than 4.03 percent each year, after that it has declined as negative -5.74 percent for 2002-06, and again less negative -1.52 percent during 2007-11 and reached an average growth rate of positive 3.69 percent during 2012-16. Data analysis shows that total food grain average growth rate, during 1997-2001 it was decreased by 2.01 percent, after that it has declined as negative -1.10 percent for 2002-06, and then it has again increased by 3.27 percent during 2007-11 and reached an average growth rate less than 1.77 percent during 2012-16.

3.3 Twin Growth (Population & Food Crops) Trends in Pakistan for Last 20 Years

Pakistan's population growth rate Kharif and Rabi Food production average growth rate in five-yearly periods are described and shown in Figure 1. It shows the magnitude of food availability and the population from 1996-97 to 2015-16, in which it can be seen that in 1997 and 1999 the food growth is higher than the population growth rate. In facts the population growth is positive but almost constant, on the other hand there are larger fluctuations in the food growth rate. According to this graph, in 2000 to 2003 the food growth rate is reach its their highest point than the population growth rate, in fact the sometime short period of upward than the population growth rate, because food growth rate is decline, than we see that against same period b/w in this year's, food growth rate is reach its their highest point in long period time of downward from the population growth rate, Accordingly, this graph, similarly during in 2004 to 2006 food growth rate is upward increased slightly than the population growth rate. Otherwise, during this period in 2007 to 2009 sometime food growth rate is reached at

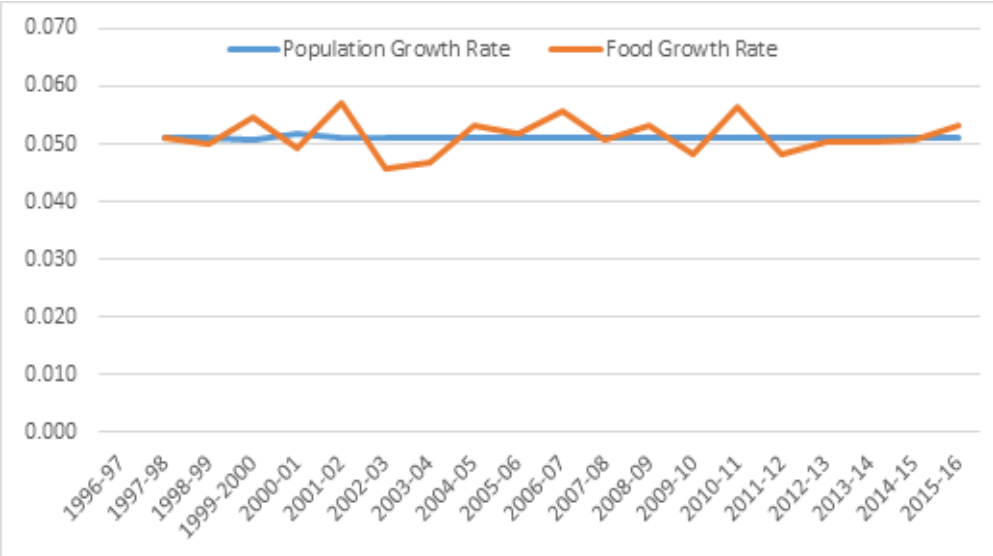

Figure 1. Trends of food crops and population in Pakistan (1997-2016).

their lowest point, than the population growth rate, and after being for a some year food growth rate is downward slightly, however on the other side there are larger fluctuations, Properly to this graph. Afterward, during in 2010 to 2012 food growth rate has showed a significant downward trend than the population growth rate, than it is seen that during the same period food growth rate is shown stay at the same level of population growth rate. In 2013 to 2016 food growth rate is constant and population growth rate is also positive, and then we finally see that same period on the other beside finger there are go up fluctuations in the food growth rate then the population growth rate. Pakistan has the lowest growth and factor productivity rate, this might be due to less agriculture technological advancement among farming communities, water scarcity, such as a mechanization and efficient irrigation techniques to farmers. Natural calamities and many others have caused the agriculture sector to have a fluctuating progress and recently a slow growth rate[23]. While looking at total food grain production in the country, the results show that the food grains are increasing by about 2.8 percent in the country, which is almost equal to the population growth rate[1]. Therefore, Pakistan's food production growth rate analysis shows irregular growth performances during last 20 years. The alarming population growth rate in Pakistan has exacerbated the food security problem. The increase in the human population (3 percent) in the last two decades has nullified increased cereal production[24-26].

4. Conclusion

At present Pakistan is a sixth most populous country in the world with projected population of 203 million. According to World Population Data Sheet 2016, Pakistan with population of 344 million in 2050 is estimated to make it 6th largest country. Where the population growth rate in Pakistan is 1.89 percent, which is higher than average growth rate of South Asian countries. In fact, Pakistan is a low income developing country, where agriculture is its most important sector due to its primary commitment of providing healthy food for its fast growing population. Normally, the population growth rate is an important indicator used to describe the change in population and play an important focal point in the economic development of a country. This would create the situation of over population. Actually, the term "Over Population" or "Population Explosion" is used to express the idea of more population for limited resources.

As regards the land resources in Pakistan, the total cultivated area has increased by just 40 percent during past 60 years, while there was more than 4 times increase in population with urban expansion of over seven fold resulting into mega-cities as well as rising population pressure on cultivated land (Ahmed and Farooq).

- The findings of the present study are based on the reviewed of previous literature. It is concluded that the overall population growth has been declined during 1994 to 2014. As per each 5th years, however, the female population growth is higher than male population.

- The findings showed that due to pull and push factor of migration, the urban population has been increased at higher rate while due to lack of rural facilities the rural population is decreased.

- The results here indicated that the food production in the country during 1995-2014 crops including (Maize, Rice, Jowar, Bajra/Millet and Sugarcane) and Rabi (Wheat, Barley, Gram, Rape & Mustard and Total Food Grain) are mostly grown in two cropping seasons in the Kharif and Rabi. However the Maize and Sugarcane crops had positive impact on growth rates during 1995-2014 and other crops like Rice, Jawar/Sorghum and Bajra/Millet, which had not only lower growth performance during the time period.

- In the light of present study the results revealed that on average yield of rice crop has 5 percent increased in the country in last 20 years, while in last five years period (2009-14) its production is declined by -0.25 percent. The reasons behind that might be climate change and flood demonstration during 2010 and 2011 has created havoc situation and majority standing crops destroyed due to flood. The rice was the 2nd one major food crop of the country.

- The results further revealed that uppermost effects of climate change in terms of rising of temperature, changing in rainfall pattern, drought and increased melting of glaciers and increased evaporation and continuously increasing demand of irrigation water requirements for food crops. The resulting less production of the crops to feed the growing population of the country.

- The results of last 20 years showed that the Rabi crops in Rabi season has no such big yield due to transfer of technology at field level. However, the results of wheat crop during last 10 years has positive yield production and resulting positive growth rate of about 2 percent.

- The finding through review of literature indicated that the population growth rate is more than 2 percent, as per 120 kg per capita requirement of wheat and wheat is considered as main or staple food grain crop, has lower growth performance in the country as compared to population growth to meet the needs of the growing population of the country.

4.1 Suggestions/Recommendations

Based on the findings the following recommendation are suggested:

- Government may take initiative with NGOs and Civil Society to frame policy for climate change and food security to cope the climate challenges at gross root levels. However, the implementation and monitoring mechanism should be framed in order to achieve the desired goal as mentioned above.

- An agriculture constitutive research group may be organized at provincial and national level in order to provide assistance to the farmers and other stockholders for promotion of research and development activities in the field of food crops.

- The study suggested that the trend of population growth will likely be more predictable and accurate than the movement of food grain production indicating an important policy implication for population reduction. The government should adopt population.

- These policies may to be introduced which include incentives for late marriage and small family size, increasing awareness of population problems and policies to improve child mortality rate so that couples are not indented to expect more children in their family.

- To Address the field level problems, it is suggested that introducing better technology such as mechanization; better packaging, efficient use of irrigation, agriculture credit, sustainable agriculture practices may be provided to the farmers through various capacity building programm at gross root levels ultimately this will support the farming community to improve the per acre yield of the crops.

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