Determinants of Food Security Among the Rural Households of the Developing Countries: A Systematic Literature Review

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Abstract

Food security is an essential concern of developing countries, primarily in rural areas. To achieve food security, it is vital to explore its determinants not only empirically but also review important studies to be undertaken to highlight the gaps left in the empirical research. Seeking this, the present systematic review and meta-analysis were accomplished to assess the determinants of food security in the rural households of developing countries. The three themes or components of food security, i.e., food availability, accessibility of food, and utilization of food, have been covered in the literature. The most studied component of food security was food availability, followed by food accessibility, while food utilization was the least studied component. The study recommends replicating such studies, and future research must be geared toward food utilization.

Keywords: Food Security, Rural Households, Developing Countries, Systematic Review, Meta-analysis

Introduction

Food security is a global issue of concern as 795 million people are facing the non-availability of food worldwide. The problem is found with more severity in the developing countries where 780 million of the total world hunger prevails. Among the developing countries, the insecurity of food is higher in Sub-Saharan African countries and South Asian countries. Later, 281 million people were found undernourished, thus ranking it as the most elevated region where hunger occurs (FAO, 2015). Therefore, food security is an important issue at the national, regional, and local levels to be addressed.

Food security is required for an individual to eliminate hunger and thus is a fundamental human right. In the light of this, food is termed as a basic necessity of life. For a life to be healthy and productive, one must have a sufficient amount of food to take with good quality and quantity (FAO, 2005). The first World Food Conference suggested achieving food security; the concept has gone through evolution, development, multiplication, and diversification since 1974 (Shiferaw et al., 2013). Afterward, various definitions were given by the researchers; however, the most common and comprehensive one was given by FAO (2004), which is "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life." The description sheds light on various components/characteristics of food security.

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Based on the definition, availability, accessibility, and utilization of food are significant components/characteristics of food security. These characteristics vary from time to time and from nation to nation, region to region, and locality to locality. The first characteristic of food security, which is food availability, depicts that it is accomplished when the proper quantity of food is available to all human beings within a state (Azam et al., 2022). The proper quantity of food can be made available to individuals of a nation by production at the household level, other domestic production, commercial import, or food assistance. The second characteristic of food security is food accessibility; it can be determined by adequate resource availability to obtain appropriate food for nutrition diet to all individuals in the country. However, access to food can be further determined by income levels, its distribution at the household level, and the prices of food in the locality. Food utilization, as the third characteristic of food security, can be achieved when the proper biological use of food is done, which is required for a balanced diet to provide sufficient energy, nutrients, water, and adequate sanitation measures. Further, food utilization can be affected by various factors at the household level, like knowledge or awareness level of food processing and shortage handling, nutrition and child care, and managing illnesses (Bashir et al., 2013; Riely et al., 1999). Proper food is vital in combating maternal mortality (Naz et al., 2022a; Naz et al., 2022b).

At the household level, all these characteristics affect food security. Food security at the household level is determined by the various factors linked to these components. Numerous research studies indicated that at the household level, food security is determined by various factors which are grouped into the three mentioned major components (Shiferaw et al., 2013; Bashir et al., 2013; Leza & Kuma, 2015; Joshi & Joshi, 2016; Ahmad et al., 2017). These studies explored the issue empirically and provided ample evidence that food security can be achieved at the household level by targeting significant factors. However, there is a need for more review studies addressing the determinants of food security at the household level (Bashir et al., 2012). Therefore, the current systematic review study on the mentioned subject is critical, highlighting the significant factors covered empirically across the developing world along with the left research gap so that the future research focus may be shifted toward the identified research gap. Seeking this, the current systematic review study has been designed to study the determinants of food security among rural households in the developing world.

Material and Methods

This study has used a systematic review type due to the associated benefits of transparency, replicability, and rigor (Mulrow, 1994). The review has been conducted using the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which was used in various fields of study (Crane et al., 2017; Phalkey et al., 2015; Liberati et al., 2009). To gather relevant peer-reviewed articles published within the set time frame of 2005 to 2017, an electronic literature search was carried out. The set time frame for this study allowed the researchers to discover the areas that have been fully covered, partially covered, or ignored in the literature. The study is also limited in geography to the developing countries. However, in terms of study design, there has been no limit. To cover the relevant literature through electronic search, various keywords have been used, like determinants, food security, factors, developing countries, etc. The literature search has been done through database searches such as Web of Science and Scopus. In the search process, keywords, titles, and abstracts of the articles were primarily focused. Initially, after the exclusion of duplicates, a total of 126 articles have been retrieved. A total of 26 articles have been retained after adopting inclusion and exclusion criteria, which were reviewed and analyzed in this study. The inclusion and exclusion criteria adopted in the current study area are as follows;

Inclusion Criterion

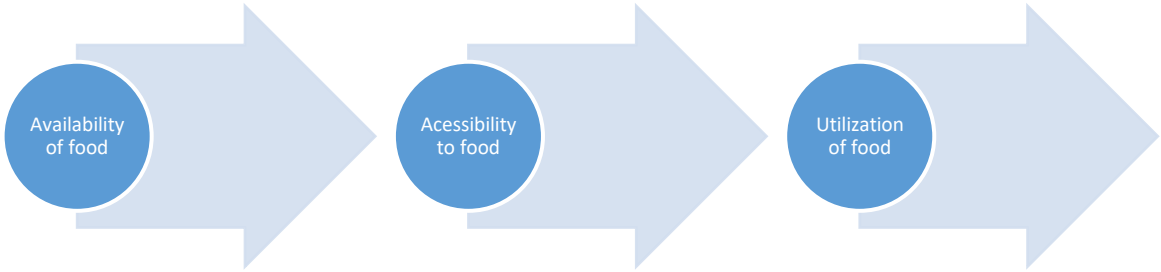
Research articles on the said topic, within the developing countries, were published in peer-reviewed journals within the time frame 2005 to 2017 and written in English language only.

Exclusion Criterion

Articles not focused on the topic, outside the developing countries, published outside the set time frame, not peer-reviewed, and written in a language other than English.

Once the 26 research articles had been retained, these articles were detailed and reviewed according to the set objectives of the study. The articles were analyzed through content analysis, and three major themes were established, including availability of food, accessibility of food, and utilization of food (Figure 1). Various sub-themes have also been identified from the published review, which have been discussed in the upcoming section of the article.

Figure-1: Themes related to the determinants of food security of rural households in the developing countries



Results and Discussion

Number and type of publications

After a detailed review of the selected literature, it has been found that all the studies were empirical. Regarding study design,8%, 81%, and 11% of studies have used descriptive, statistical modeling, and both methods, respectively. The results indicate that most of the studies have used statistical modeling, so an effort has been made in the literature to identify the determinants of food security through appropriate application study design. Thus, the results may consider satisfactory. In the case of accessibility of food, household size, dependency ratio.

Table 1 Type of study design used in the reviewed publications

Type of study design	Frequency	Percentage
Descriptive	2	8
Statistical Modelling	21	81
Both descriptive and statistical modelling	3	11
Total	26	100

Determinants of Food Security

Data in Table 2 show the summary of results related to the determinants of food security from the reviewed publications. The determinants of food security were grouped under the three

components of food security, i.e., availability of food, accessibility of food, and utilization of food. The categories of availability of food, livestock holding, technology, farm size, credit, inputs, education, household head age, distance to market, ownership of land, extension, and farming experience were identified as the determinants of food security. In the case of accessibility of food, income level, off-farm activities, non-farm activities, foreign remittances, and household labor were the studied determinants in the selected literature. Gender/sex and expenditures on health and food were the studied determinants under the category of utilization of food. The determinants under each component of food security have been discussed in detail as follows.

Food Availability

Food availability is ensured by self-production and market purchases. The current review study highlighted various determinants that affect food availability and, thus, food security. The highlighted determinants are discussed one by one in detail as follows.

Livestock:

Livestock significantly determinants rural households' food security because livestock provides food (i.e., milk, milk products, and meat) along with financial security (Naz & Khan, 2018). Livestock served as an essential asset that can be sold out during food shortages or agricultural stresses. Surplus products like milk and milk products are also sold out, and the cash earned may also be utilized for food items. Thus, a large number of livestock within a household increases the chances of food security. In Ethiopia, numerous studies endorsed livestock holding as a positive and significant determinant of food security. Researchers argued that farmers with extensive livestock holdings may earn more from their produce, which is further used for purchasing food items. Thus, livestock ensures household food security. It has been found from the review of selected literature that food-secure households possess more livestock than food-insecure ones (Beyene & Muche, 2010; Asmelash, 2014; Abdullah, 2015; Leza & Kuma, 2015; Dawit, 2017; Aragie & Genanu, 2017). Similarly, livestock holding was found to be the significant determinant/predictor of food security in Zimbabwe (Mango et al., 2014), Tanzania (Ngongi & Urassa, 2014), and Nigeria (Idresia et al., 2008).

Technology:

Technology is a significant determinant of food availability in Pakistan (Bashir, 2013), which shows that technological adoption results in increased production and a high level of farm income. Increased production increases household food availability, while a high level of farm income results in an increase in household food expenditures.

Credit:

Access to credit largely determines the food security situation of rural households. Access to credit enables farmers to purchase or afford inputs like fertilizer, insecticides, pesticides, machinery, livestock, etc., which positively affects production levels and thus increases the probability of a household being more food secure (Ahmed et al., 2015). Furthermore, credit improves household's purchasing power and investments in businesses, which improves household financial capacity as found in Nigeria (Ahmed & Abah, 2014). Thus, access to credit reduces the risk of food insecurity among rural households, as reported in Ghana (Kuwornu et al., 2012), Ethiopia (Aragi & Genanu, 2017; Dawit, 2017), Pakistan (Ahmed et al., 2017), and Nigeria (Agada & Igbokwe, 2014; Leza & Kuma, 2015; Ahmed et al., 2015).

Inputs:

The availability and use of inputs (fertilizer, machinery, chemicals, etc.) positively affect a household's food security. Access and use of fertilizer increases the chances of households being more food secure. In contrast, limited access to and use of fertilizer led to an increase in the risk of a household's food insecurity. The use of fertilizer significantly improves farm

production, which increases food availability among rural households (Aragi & Genanu, 2017). In Ethiopia, has been endorsed by various researchers that the access and use of inputs is a significant determinant of rural household's food security (Beyene & Muche, 2010; Asmelash, 2014; Ababbo et al., 2015; Abdullah, 2015; Dawit, 2017; Aragi & Genanu, 2017). Similar results have been found in Pakistan (Bashir, 2013), Tanzania (Ngongi & Urassa, 2014), and Nigeria (Agada & Igbokwe, 2014).

Farm size:

Farm size is positively related to the household food security situation. In this regard, from the review of selected literature, it has been found that due to large farm size, household food production increases, which on the one hand increases the food availability but also provides income for the purchase of food items, thus positively affecting the households' food security situation (Ahmad et al., 2015). It indicates that a large farm size ensures a household's food security. Additionally, the size of cultivated land has a significant bearing on the rural households' food security status (Amselas, 2014). The large size of cultivated land results in more production, and thus, the chances of households' food security increases. In Nigeria, it has been found that a large farm size ensures household food security compared to a small farm size (Ahmad & Abha, 2014; Agada & Igbokwe, 2014; Leza & Kuma, 2015). Similar findings have been reported in Ethiopia (Beyene & Muche, 2010; Asmelash, 2014; Abdullah, 2015; Aragie & Genanu, 2017), Nepal (Joshi & Joshi, 2016), Ghana (Kuwornu et al., 2012), and Pakistan (Ahmed et al., 2017).

Education of the household head:

It was a vital determinant of rural households' food security status (Ahmed & Abha, 2014). Progression in the educational level of a household head increases the probability of that household being more food secure. These results have been endorsed by Anila and Kiani (2011), who reported that households, where the heads had above intermediate level education were found to be food secure compared to the illiterate and those with low levels of education. Similarly, another study conducted in Nepal has endorsed these facts and reported that the household head's educational level improves working efficiency, competency, income diversification, and technological adoption, which have positive effects on better living conditions and food security (Joshi & Joshi, 2016). Similar results have been reported in Nigeria (Idresia et al., 2008; Irohib & Agwu, 2014; Ahmed & Abha, 2014; Ahmed et al., 2015), Pakistan (Bashir et al., 2012; Bashir, 2013; Cheema & Abbas, 2016; Abdullah et al., 2017), Ethiopia (Beyene & Muche, 2010; Ababbo et al., 2015; Aragie and genanu 2017; Dawit, 2017), Zimbabwe (Mango et al., 2014), Ghana (Kuwornu et al., 2012), Tanzania (Ngongi & Urassa, 2014), and Iran (Ghulami et al., 2013).

Age of the household head:

The age of the household head relates to the household's food security in the rural areas of developing countries. In this regard, mixed results have been reported. Some researchers found that household head age positively affects a household's food security, while some reported otherwise (Kuwornu et al., 2012; Abdullah et al., 2017). In Zimbabwe and Ghana, it has been found that older household heads increase the chances of a household's food security due to their experience in income-generating activities (Kuwornu et al., 2012; Mango et al., 2014). In India, it has been reported that the age of the household head positively influences the consumption of calories and protein in a household (Kumar et al., 2012). The reason behind the positive influence or effect is related to household heads' more extended stay in their public service or private business endeavors, as found in Nigeria. (Ahmed et al., 2015; Agada and Igbokwe 2014; Ahmad and Abah 2014; Idresia et al., 2008). Contrary results have been reported to the above studies that older household heads increase the chances of a household's food insecurity in Pakistan (Bashir et al., 2012; Bashir, 2013; Abdullah et al., 2017). Various studies in Ethiopia have reported that young age household heads increase the chances of

households being more food secure because they tend to diversify household income and take initiative (Beyene & Much, 2010; Leza & Kuma, 2015; Aragie & Genanu, 2017).

Distance to the market:

The market plays a vital role in determining the food security status of a household as it indicates the access and availability of food in Pakistan (Ahmed et al., 2017; Bashir, 2013). Distance from the market center has a negative and significant relation with household food security in Ethiopia. It was found that one kilometer away from the market center, the probability of households being food secure will decrease (Ababbo et al., 2015). The nearness of the households to the market centers (market distance) facilitates the buying of household needs and selling of home-produced products in Nepal (Joshi & Joshi, 2016) and in Iran (Gholami et al., 2013).

Land ownership:

Land ownership has a positive and significant influence on household food security. Ownership of land enhances the possibilities for home production and thus improves the nutritional intake in India (Kumar et al., 2012). Land ownership may not be a significant predictor of food security, but its utilization may be protective against household food insecurity. Access to land is a crucial strategy to reduce rural poverty and ensure food security in Nepal (Joshi & Joshi, 2016), Ghana (Kuwornu et al., 2012), and Malaysia (Sharif & Khor, 2008).

Extension:

Households' access to extension agents has a positive and significant effect on food security status. Households that have access to extension agents have a higher probability of being food secure in Nigeria (Ahmed & Abah, 2014). The author further denoted that access to extension agents enhances the chances of households having better crop production techniques, improved inputs, and other production incentives, and these affect their output and their food security status. Extension services are meant to enhance the chances of a household having access to better crop production techniques, improved inputs, and production incentives that positively affect farm productivity and production in Ethiopia (Leza & Kuma, 2015; Aragie andGenanu, 2017) and Nigeria (Ahmed et al., 2015).

Farming Experience:

Farming experience has a significant positive effect on a household's food security. Increased farming experience may result in increased food production and, therefore, a solution to the food security problem in Nigeria (Ahmed & Abah, 2014). An experienced household head is expected to have more insight and ability to diversify his or her production to minimize the risk of food shortage. It is more likely to have adequate knowledge of pests, disease management, and weather, as reported in Ethiopia (Dawit, 2017), Tanzania (Ngongi & Urassa, 2014), and Ghana (Kuwornu et al., 2012).

Besides the above determinants, technology and farming systems were also the determinants of food availability in Pakistan (Bashir, 2013).

Table 2 Summary on the determinants of food security (food availability) from reviewed publications N=26

Determinants	
Availability of food	
Livestock holding	Livestock ensures household food security (Dawit, 2017) Large livestock holdings is possessed by food secure households (Beyene and Muche, 2010; Asmelash, 2014; Leza and Kuma, 2015; Abdullah, 2015; Dawit, 2017; Aragie and Genanu, 2017). Livestock found as the significant determinant in Nigeria (Idresia et al., 2008), Zimbabwe (Mango et al., 2014), and Tanzania (Ngongi and Urassa 2014).
Technology	Technology has been found as the significant determinants of food availability in Pakistan (Bashir, 2013).
Credit	Access to credit reduces the risk of household food insecurity in Ghana (Kuwornu et al., 2012), Pakistan (Ahmed et al., 2017), Ethiopia (Aragi and Genanu, 2017; Dawit 2017), and in Nigeria (Agada and Igbokwe, 2014; Ahmed et al., 2015; Leza and Kuma, 2015).
Inputs (fertilizer, machinery, and chemicals)	The access and use of inputs significantly determined household's food security in Ethopia (Beyene and Muche, 2010; Asmelash, 2014; Ababbo et al., 2015; Abdullah 2015; Dawit, 2017; Aragi and Genanu 2017), Tanzania (Ngongi and Urassa 2014), Pakistan (Bashir, 2013), and in Nigeria (Agada and Igbokwe, 2014). Use of inputs increases production and thus increases availability of food for households (Ngongi and Urassa 2014; Dawit, 2017)
Education of the household head	Education of the household head enhances working efficiency and competency, income diversification, and technological adoption which results in improved living conditions and food security (Joshi and Joshi, 2016). In Pakistan, household head's education of above intermediate level has been reported as the positive influencing factor (Anila and Kiani, 2011). Household head education positively affected food availability in Nigeria (Idresia et al 2008; Ahmed and Abha, 2014; Irohib and Agwu, 2014; Ahmed et al., 2015), Pakistan (Basher et al., 2012; Bashir, 2013; Cheema and Abbas, 2016; Abdullah et al., 2017), Ethiopia (Beyene and Muche 2010; Ababbo et al., 2015; Aragie and genanu 2017; Dawit 2017), Zimbabwe (Mango et al., 2014), Tanzania (Ngongi and Urassa 2014), Iran (Ghulami et al., 2013), and in Ghana (Kuwornu et al., 2012).
Household head age	Households headed by older people are found as food secure in Ghana (Kuwornu et al., 2012), Zimbabwe (Mango et al., 2014), and Nigeria (Ahmed et al., 2015; Agada and Igbokwe 2014; Ahmad and Abah 2014; Idresia et al., 2008). Contrary results have been found in Pakistan (Bashir et al., 2012; Bashir 2013; Abdullah et al., 2017) and Ethiopia (Beyene and Much, 2010; Leza and Kuma 2015; Aragie and Genanu 2017).
Farming system	Farming system is found as the significant determinants of food availability in Pakistan (Bashir, 2013).

Farm size	Large farm size has found as the positive significant determinant in Ethiopia (Beyene and Muche, 2010; Asmelash, 2014; Abdullah, 2015; Aragie and Genanu, 2017), Nepal (Joshi and Joshi, 2016), Ghana (Kuwornu et al., 2012)' and Pakistan (Ahmed et al., 2017).
Land owner ship	Positive and significant determinant (Kumar et al., 2012). Access to land ensures food security in Nepal (Joshi and Joshi 2016), Ghana (Kuwornu et al., 2012), and in Malaysia (Sharif and Khor, 2008).
Farming Experience of household head	It has been found as the positive and significant determinant in Nigeria (Ahmed and Abah, 2014). Experience enables a household head to be more insightful and to diversify production as found in Tanzania (Ngongi and Urassa, 2014), Ethiopia (Dawit, 2017), and Ghana (Kuwornu et al., 2012).
Distance to market	It has been found as the negative significant determinant in Ethiopia (Ababbo et al., 2015). One kilometer away from market center, decreases the probability of households' food security (Ababbo et al., 2015).
Extension	In Nigeria, access to extension services has increased food security (Ahmed and Abah, 2014). Extension services enhances household's food security through increased farm productivity and production Leza and Kuma 2015; Ahmed et al., 2015; Aragie and Genanu 2017). Extension services enhances access to improved crop production techniques, modern inputs, and production incentives in Ethiopia (Leza and Kuma 2015; Aragie and Genanu 2017) and Nigeria (Ahmed et al., 2015).

Food Accessibility

Despite food availability in various regions, food insecurity has increased over time. Food availability alone cannot ensure a household's food security, as accessibility is a limiting factor (Sen, 1981; Dreze & Sen, 1989; Bashir et al., 2013). Thus, the following factors of food accessibility were identified during the review of the selected literature.

Size of Household:

Household size is an essential determinant of food accessibility and is usually a negative predictor. In Nepal, it was found that households who depend on limited productive resources face food insecurity with increasing family size (Joshi & Joshi, 2016). Similar findings have been noted in Zimbabwe and reported that sizeable-sized household put pressure on households for food and thus increases food insecurity status (Mango et al., 2014). Households with large sizes have a higher possibility of being food insecure than those smaller sizes, and when there are more dependents, then there is a need for more food, as in Nigeria (Ahmed et al., 2015; Irohibe & Agwu, 2014; Agada & Igbokwe, 2014; Nigogi & Urassa, 2014; Ahmed & Sabah, 2014; Idrisa et al., 2008). In Pakistan, it was found that food and household with a high dependency ratio implies more people are fed from limited resources (Ahmed et al., 2017; Bashir et al., 2012). Similar findings have been reported in Ethiopia as well by various researchers like Aragie and Genanu (2017), Dawit (2017), Leza and Kuma (2015), Ababbo et al. (2015), Asmelash (2014), Beyene and Much (2010).

Dependency Ratio:

The dependency ratio is a negative and significant determinant of rural household's food security. Households with a more inactive labor force show a high dependency ratio and thus

increase the chances of households being food insecure, as reported in Ethiopia by Aragie and Genanu (2017).

In Ghana, it was found that an increase in the number of non-working members of a household or dependency ratio increases the food insecurity level of households (Kuwornu et al., (2012). It was also true for Pakistan (Anila & Kiani, 2011; Cheema & Abbas, 2016).

Level of Income:

Annual income has a positive role in households' food security; the more the earnings in a household, the more they have to spend on food, as found in Ghana (Kuwornu et al., 2012) and also in Tanzania (Ngongi & Urassa, 2014). Higher-income households increased the accessibility to food production and supply and vice versa for lower-income households. Limited income has a negative impact on the food security situation of households in Nigeria. (Idrisa et al., 2008; Ahmed and Abah 2014; Ahmed et al., 2015). In Ethiopia, it has been found that food accessibility was directly related to higher income levels and thus contributed to food security (Leza & Kuma, 2015; Asmelash, 2014; Beyene & Much, 2010). Identical results have been reported in Nepal by Joshi and Joshi (2016) and in Pakistan by Ahmed et al. (2017), Cheema and Abass (2016), Bashir (2013), and Bashir et al. (2012). Income enhances the purchasing power of a household and thus increases the per capita nutritional intake, as found in India (Kumar et al., 2012) and Malaysia (Sharif & Khor, 2008).

Off-farm activities:

Off-farm activities at the household level determine its food security status. Engagement in an activity can bring in money, thereby supporting the food security situation of the households. It is endorsed by various researchers in Ethiopia (Aragie & Genanu, 2017; Abbaboo et al., 2015) and Ghana (Kuwornu et al., 2012).

Nonfarm activities:

Nonfarm income was found to have a significant and positive relation with the food security status of the household. The households engaged in nonfarm activities are better endowed with additional income and more likely to escape food insecurity in Ethiopia (Aragie & Genanu, 2017; Abdullah, 2015).

Foreign remittances:

Remittances have a positive relation with the rural households' food security. Mango et al. (2014) found that households with access to remittances can purchase more appropriate and nutritious foods than low-income groups in Zimbabwe. The same fact has been endorsed in Pakistan, and it has been reported that remittances led to enhanced household capacity to consume more food, thus positively contributing to food security (Abdullah et al., 2017; Cheema & Abbas, 2016).

Household labor:

Household labor has a positive relationship with household food security. Households with large labor pools are more likely to be food secure, as they can carry out farming activities on time, as found in Zimbabwe (Mango et al., 2014).

Table 3 Summary on the determinants of food security (accessibility) from reviewed publications N=26

Determinants	
Household size	Large household size negatively affect household's food security (Joshi and Joshi, 2016). Large sized households had to feed more number of people and thus they are likely to be food insecure (Mango et al., 2014). Small sized households were usually found food secure (Agada and Igbokwe 2014).

	Increased family size along with the more number of dependents in a household led to food insecurity in Nigeria (Idrisa et al., 2008; Nigogi and Urassa 2014; Ahmed and Abah 2014; Agada and Igbokwe 2014; Irohibe and Agwu 2014; Ahmed et al., 2015), Ethiopia (Beyene and Much 2010; Asmelash 2014; Ababbo et al., 2015; Leza and Kuma 2015; Aragie and Genanu 2017; Dawit 2017), and Pakistan. (Bashir et al., 2012; Ahmed et al., 2017).
Dependency ratio	Dependency ratio served as the negative significant determinant of rural household's food security (Cheema and Abbas 2016). Households with high dependency ratio (inactive labor force) were found to be food insecure in Ethiopia (Aragie and Genanu, 2017), Ghana (Kuwornu et al., 2012) and Pakistan (Anila and Kiani 2011; Cheema and Abbas 2016).
Income level	Income has positive role in households' food security (Ngongi and Urassa, 2014). Higher income level of a household led to increased household food expenditures (Ngongi and Urassa, 2014; Kuwornu et al., 2012). Limited income has negative impact on the households' food security as reported in Nigeria. (Ahmed et al., 2015; Ahmed and Abah 2014; Idrisa et al., 2008). Higher income levels ensures increased access to food in Ethiopia as reported by Beyene and Much, (2010), Asmelash (2014), Leza and Kuma (2015). Similar findings have been reported in Pakistan by Bashir et al., (2012), Bashir, (2013), Cheema and Abass, (2016), and Ahmed et al., (2017). In Nepal, Joshi and Joshi (2016) endorsed the mentioned results as well. Income enhances the purchasing power of a household and also the per capita nutritional intake as found in India (Kumar et al 2012) and Malaysia (Sharif and Khor 2008).
Off farm activities	Off-farm activities at household level positively affect household's food security status (Abbaboo et al., 2015). Engagement in an off farm activity results in earning which may led to increase in household's consumption expenditures as found in Ethiopia (Abbaboo et al., 2015; Aragie and Genanu 2017) and Ghana (Kuwornu et al., 2012).
Non-farm activities	Non-farm activities served as the positive significant influencing factor to food security status of the rural household. Non-farm activities engagement results in earnings and thus increases the chances of a household to escape from food insecurity as found in Ethiopia (Abdullah 2015; Aragie and Genanu 2017).
Foreign remittances	Remittances served as the positive significant factor (Cheema and Abbas, 2016). Remittances enhances household's ability to purchase appropriate and nutritious foods as compared to those who had no or limited access to remittences (Mango et al., 2014). Increase in income by remittances positively affect household expenditure and thus, households tend to consume more food (Cheema and Abbas, 2016; Abdullah et al., 2017).
Household labour	The household labor served as the positive significant determinant. Households having large pools of labor are usually found food secure due to the fact that farming activities can be completed in time (Mango et al., 2014).

Food Utilization

The factors affecting food utilization in the review of the selected literature are given below.

Gender/Sex:

Male-headed households have a better relation with food security than female-headed. Thus, male-headed households are more likely to be food secure than female-headed households. It indicates that the sex of the household is an essential determinant of household food security, as reported in Nepal (Joshi & Joshi, 2016). In Zimbabwe, it was reported that male-headed households are better positioned to source on-farm labor than their female-headed counterparts, thus leading to food security (Mango et al. (2014). Households headed by males have a higher probability of being food secure than their females. Female household heads were usually saddled with the responsibility of homekeeping and raising children, which usually limits their engagement in some income-generating activities compared to their male as found in Nigeria by Ahmed et al. (2015), Irohibe and Agwu (2014), and Ahmed and Abah (2014). Female-headed households are more exposed to the risk of food insecurity because of their limited access to livelihood assets in Ethiopia (Aragie & Genanu, 2017; Abdullah, 2015). Female-headed households have higher dependency ratios, which hinders the household capacity to allocate labor to on-farm or other income-generating activities found in Pakistan (Cheema & Abbas, 2016) in Rwanda (Habyarimana, 2015) in Ghana (Kuwornu et al., 2012).

Expenditures on health and food:

Expenditure on food was significantly associated with a household's food security. Households with more income are expected to be more food secure than poor ones in Tanzania (Ngongi & Urassa, 2014) as they spend more on health and food and, thus, are less like to face food insecurity problems as compared to those who do not spend more on food and health as found in Ethiopia (Aragie & Genanu, 2017) and Pakistan (Bashir, 2013; Ahmed et al., 2017).

Table 4 Summary on the determinants of food security (food utilization) from reviewed publications N=26

Determinants	
Gender/sex	Male headed household are more likely to be food secure than female headed households in Nepal (Joshi and Joshi, 2016), Zimbabwe Mango et al (2014). Female headed households are mostly food insecure due to their limited access to livelihood assets in Ethiopia (Aragie and Genanu 2017; Abdullah 2015). Female headed households have higher dependency ratios in Pakistan (Cheema and Abbas 2016), Rwanda (Habyarimana 2015), and in Ghana (Kuwornu et al., 2012).
Expenditures on health and food	Households with more income are more food secure than poor ones in Tanazania (Ngongi and Urassa, 2014) as they spend more on health and food. Expenditures on health and food are found less in in Ethiopia (Aragie and Genanu 2017) and Pakistan (Bashir 2013; Ahmed et al 2017) which result in food insecurity.

Coverage of Determinants of Food Security through Meta-Analysis

It has been found that in the case of food availability, education, household head age, farm size, inputs availability and use, livestock holdings, and credit availability were the most studied determinants. Household size and income level of households were the most studied components in terms of their determinants. The distinction between the satisfactory and partial answers was made based on the adopted methodology towards the anomaly. The studies that

used descriptive statistics were considered partial answers because they just indicated the problem and did not address to which extent the factors affect the said issue.

Table 5 shows an overview of the coverage of determinants of food security among rural households in developing countries. The table highlights the potential gaps in the particular issue. The most studied determinants of food availability were education, household head age, farm size, inputs availability and use, livestock holdings, and credit availability. Regarding food accessibility, the most studied determinants were household size and income level of households. For food utilization, sex was the most studied determinant.

Overall, five factors, education, household size, income level of household, household head age, and farm size, were the most studied determinants of food security. The least studied determinants included household labor, engagement in non-farm activities, engagement in off-farm activities, foreign remittances, extension contact, farming experience, and distance to market. Thus, the most studied component of food security was food availability, followed by food accessibility and utilization.

Table 5 The determinants of food security after reviewing the selected literature

Determinants of availability of food	Country	Partial answer	Satisfactory answer
Livestock holding	Ethiopia, Zimbabwe, Nigeria, Tanzania.	07, 09, 10, 11, 26,	08, 09, 10, 11, 12,20, 23, 26
Technology	Pakistan	--	17
Credit	Nigeria, Ethiopia, Tanzania, Ghana,	10, 11,	05, 06 10, 11, 16, 18, 21, 23
Inputs	Ethiopia, India, Nepal, Tanzania, Pakistan, Nigeria	09, 11,	08, 09, 11, 12, 17, 18 20, 23, 25
Education	Ethiopia, Pakistan, India, Nepal, Nigeria, Tanzania, Zimbabwe, Ghana	07, 09, 11, 26,	01, 03, 04,05, 06, 09, 11, 13, 14, 15,17 19, 20, 21, 23, 25, 26
Household head age	India, Nigeria, Pakistan, Tanzania, Ethiopia, Zimbabwe, Ghana, Rwanda	09, 10, 26, 07,	02, 05, 06, 09, 10, 15, 17, 18, 19, 21, 23, 26
Farming system	Pakistan	--	17
Farm size	Ethiopia, India,Nigeria, Pakistan, Ghana	09, 10,	03, 05, 06, 08, 09, 10, 12, 16, 18, 21, 23
Land owner ship	India, Nepal, Ghana, Malaysia,	22,	02, 03, 21, 22
Farming Experience:	Nigeria, Tanzania, Ghana	11	05, 11, 20, 21
Distance to the market	Ethiopia, Nepal, Iran, Pakistan,	--	25, 03, 13, 16, 17
Extension	Nigeria, Ethiopia	10	05, 06, 10, 23
Determinants of Food Accessibilities:			
Income	India, Nigeria, Ethiopia, Pakistan, Tanzania, Ghana, Malaysia,	07, 10, 22,	02, 03, 05, 06, 08, 09, 10, 14, 16, 17, 19, 20, 21, 22
Household size	Ethiopia, Nepal, Nigeria, Pakistan, Zimbabwe	07, 09, 10, 11, 26	03, 04, 05, 06, 08, 09, 10, 11, 15, 16, 18, 19, 20, 23
Dependency ratio	Pakistan, Ethiopia, Ghana	--	01, 14, 21, 23
Foreign remittance	Pakistan, Zimbabwe	26,	14, 15, 26
Off-farm activities	Ethiopia, Ghana	--	21, 23, 25,
Non-farm activities	Ethiopia	--	12, 23,
Household labour	Zimbabwe	26	26
Determinates of Food Utilization:			
Gender/Sex	Nepal, Nigeria, Pakistan, Ethiopia, Ghana, Rwanda, Zimbabwe	--	03, 04, 05, 06, 12, 14, 21, 23, 24, 26
Expenditures on health and food	Pakistan	--	16, 17, 23, 20

Note: The numbering in the table is according to the assigned numbers of research studies given in the annexure

Conclusion and Recommendations

The current systematic review has studied 26 peer-reviewed published research articles after adopting inclusion and exclusion criteria. Most of the studies have used statistical modeling for the estimation of determinants of food security, which indicates that these studies have used appropriate tools for analysis. Thus, the results may be trustworthy as well. From the review of the selected literature, three main themes of food security, i.e., food availability, accessibility, and utilization of food, have been identified. Under the first theme (the availability of food), income, household size, dependency ratio, foreign remittances, off-farm activities, non-farm activities, and household labor were the identified determinants, while under the theme of the utilization of food, gender/sex, and expenditures on health and food were the studied determinants. Results indicate that the most studied theme of food security was the availability of food, while the least studied theme was the utilization of food. Overall, five factors, education, household size, income level of household, household head age, and farm size, were the most studied determinants of food security. The least studied determinants included household labor, engagement in non-farm activities, engagement in off-farm activities, foreign remittances, extension contact, farming experience, and distance to market. The study suggests that similar studies should be conducted following the conceptual model of food security, which will better identify the gaps left in the empirical research on the said subject. Moreover, food utilization was the least studied component of food security, so future research must consider it to fill the left research gap.

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Annexure-I

Selected studies for reviewing determinants of food security in the developing countries

S. No.	Study	Country	Empirical method
1	Sultana and Kiani, 2011	Pakistan	Logistic regression
2	Kumar et al., 2012	India	Log linear regression model
3	Joshi and Joshi, 2016	Nepal	Tobit model
4	Irohibe and Agwu, 2014	Nigeria	Logistic regression
5	Ahmed and Abha, 2014	Nigeria	Logistic regression
6	Ahmed et al., 2015	Nigeria	Logistic regression
7	Idrisa et al., 2008	Nigeria	Descriptive
8	Amselah, 2014	Ethiopia	Logistic regression
9	Beyene and Muche, 2010	Ethiopia	Descriptive and logistic regression
10	Leza and Kuma, 2015	Ethiopia	Descriptive and Logistic regression
11	Dawit, 2017	Ethiopia	Multiple linear regression
12	Abdullah, 2015	Ethiopia	Univariate and ordered logit regression
13	Gholami et al., 2013	Iran	Logistic regression
14	Cheema and Abbas, 2016	Pakistan	Logistic regression
15	Abdullah et al., 2017	Pakistan	Logistic regression
16	Ahmed et al., 2017	Pakistan	Logistic regression
17	Bashir et al., 2013	Pakistan	Univariate analysis (chi-square)/descriptive
18	Igada and Ikbowe, 2014	Nigeria	Logistic regression
19	Bashir et al., 2012	Pakistan	Logistic regression
20	Ngongi and Urassa, 2014	Tanzania	Multiple regression
21	Kuwornu et al., year???	Ghana	Logistic regression
22	Sharif and Khor, 2008	Malaysia	Descriptive and logistic regression
23	Aragie and Genanu, 2017	Nigeria	Logistic regression
24	Habyarimana, 2015	Rwanda	Probit Regression
25	Abobo et al., (2016)	Ethiopia	Logistic regression
26	Mango et al., (2014)	Zimbabwe	linear regression