Review Article

FOOD AVAILABILITY AND CONSUMPTION IN RELATION TO DEVELOPING STRATEGIES FOR SUSTAINED PRODUCTION AND SUPPLY IN NEPAL

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ABSTRACT

Nepal is classified as severe localized food insecure country with increasing import dependency ratio in each year. Relevant literatures and available data were reviewed in 2018 to find the trend of food availability and consumption in relation to developing strategies for sustained production and supply in Nepal. The per capita calories uptake is higher (2830 versus 2220 kcal) with higher in rural communities and to the richer families (4000 kcal/person/day). Whereas the protein and edible oil and fat uptake is increasing, but are yet insufficient. The diet is mostly dominated by cereals and the consumption of pulses, fruit, vegetables and animal products were comparatively lower. There is double burden of women under-nutrition (18.2%) and over-nutrition (13.5%). At present, Nepal is self sufficient only on tea, coffee, and poultry eggs. Where the import dependency ratio of fruit (88.1%), oils (83.5%) and pulses (73.4%) were very high and are in increasing trend. However, the self sufficiency ratios of cereals (97.4%), vegetables (65.9%), potato (88.8%), milk (79%), sugar (62.6%) and meat (61%) are still higher. Raising the productivity of cereals by 0.06 t/ha, vegetables 3.49 t/ha, potato/tubers 1.59 t/ha, spices 0.58 t/ha, milk 0.30 t/head and a considerable increment of meat productivity could make the country self sufficient. Moreover, it is very hard to be self sufficient on fruit, oilseed, and fish because of their small area coverage/herd sizes, low productivity and long gestation period required. It is needed to prioritize the commodities for the allocation of production areas/heard sizes, linking all the development/infrastructure programs and output based investment for improved food production, marketing and consumption to restore national food sufficiency for livelihood support and economic resilience.

Key words: Commodities, nutrition, sufficiency, balance, import

INTRODUCTION

Importance of the food is justified by the quotation of Buck (2017) that “A hungry man can't see right or wrong, he just sees food". Global food security index (2016) stated overall rankings of the countries across the world. Nepal ranks 82nd out of 113 countries scoring 42.9 (Figure 1). About one fourth of the people in Nepal are still below poverty line with daily per-capita consumption of energy less than 2220 Kcal (CBS, 2011). Nepal has been placed as severe localized food insecure country (FAO, 2003). It was warned that 3.9 million people in Nepal were facing food insecurity and 40% population is undernourished (WFP, 2015). Alarming food crisis in Nepal was reported in 43 districts in 2010 which had also included some of the Terai districts previously considered the grain bowl of Nepal. There is alarming rate of Protein Energy Malnutrition (PEM) in Nepal, indicated by wasting.

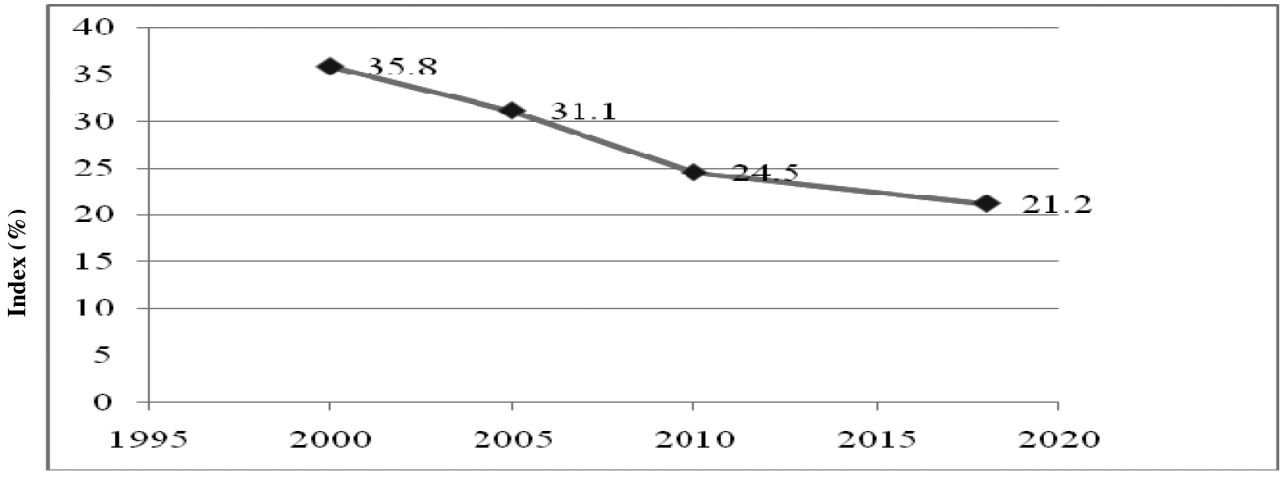


Figure 1. Trend of Global Hunger Score of Nepal, 2018 stunting, and malnutrition (MoHP, 2011)

Food price fluctuations are occurring frequently due to blockade, earthquake, *banda*/strikes, extreme weathers and other economic factors in Nepal. There lacks a well developed food supply systems including the food collection and distribution system (Pokhrel, 2018). Marketing net work is very weak. There is rice culture and nutrition of local food is not known (Pokhrel et al., 2017). Diversification of local food products and subsidy support on local production are negligible. Food inspections and regulation related business are challenging and difficult due to scattered and large number of primary producers, traders and retailers (Singh, 2008). However, Nepal has been committed on food and nutrition security, right to food and food sovereignty and Zero Hunger Initiatives (GHI) in the country, through agriculture development strategy (ADS), different legal documents and the constitution of Nepal (GON, 2014 ; NLC, 2015). Under this context, this review was done to narrate the critical context of overall food security situation in Nepal. The main objective of this review was to find the trend of food availability and consumption in relation to developing strategies for sustained production and supply, and make strategic recommendation for the food self-sufficiency in Nepal.

MATERIAL AND METHOD

Available reports from Government of Nepal (GoN), papers published from FAO and WHO, scientific papers, books and journal articles related to food and nutrition availability, hunger, malnutrition and population were collected and reviewed. Web pages were visited for collecting necessary information. The agriculture statistics like, crop area, livestock population, food productions, import and export were taken from secondary sources mainly from Statistical Information on Nepalese Agriculture and Ministry of Agriculture Development. Food recommendations were considered the recommendation of Indian Council of Medical Research (ICMR, 1985), and World Health Organization (WHO, 1986) recommendation to calculate the per capita food requirement in Nepal. Food consumption was calculated based on the following formula:

$$\text{Per capita food consumption (kg/yr/person)} = \frac{\text{National production (milled, t) + import (milled, t) - export (milled, t)}}{\text{Population}}$$

Data on per capita food consumption (kg/yr/person), yearly food consumption in Nepal, and yearly requirement of food based on the ICMR and WHO recommendation, yearly food deficit by consumption and recommendation, and needed area expansion or the needed rise in productivity to meet national self-sufficiency were calculated. The food self-sufficiency ratio (SSR) and the import dependency ratio (IDR) were calculated based on the following formula:

IDR= SSR - 100

$$\text{SSR} = \frac{\text{Total consumption (milled, t) - import (milled, t) X 100}}{\text{Total consumption (milled, t)}}$$

All the data derived from calculation were entered in appropriate computer program and software and analyzed for getting findings. Findings were presented in tabular and diagrammatic forms. Finally, the future strategy needed to meet the national food self sufficiency in Nepal is recommended.

RESULTS/FINDINGS

Overall food situations in Nepal

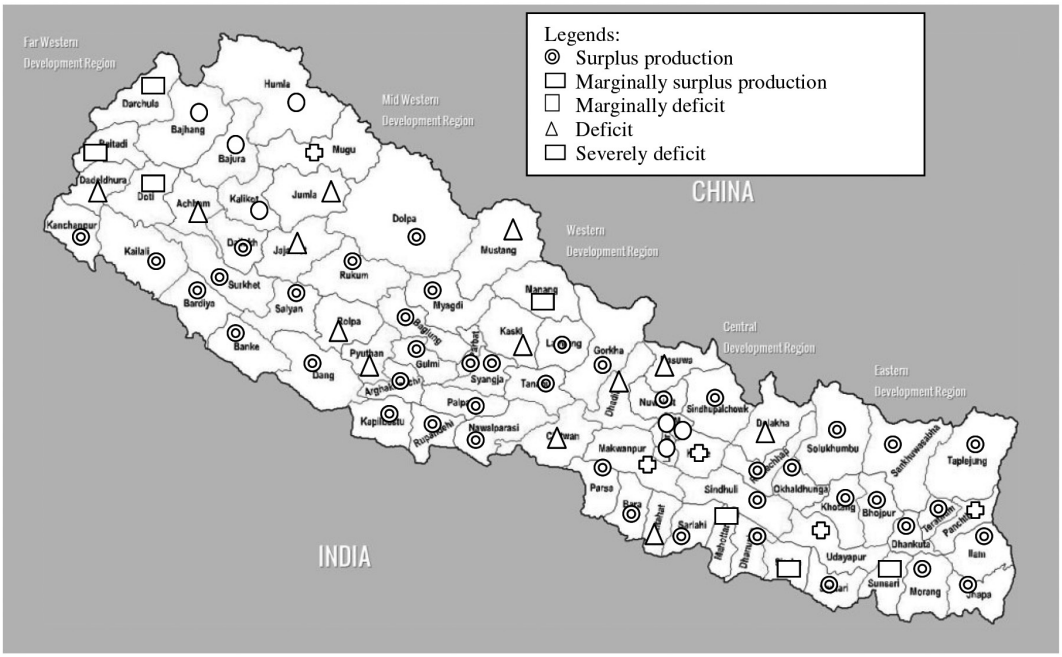
Over all Nepalese situations seems low level of investment in agriculture sector. Food security programs are poorly coordinated. Market network and other infrastructure development are slow. Nutrition programs have not produced results as per expectations and there lacks a planned food and nutrition programs. It is reflected from the Global Food Security Index, Global Hunger Score and the food Self Sufficiency Ratio are given in following sub-sections.

Trend of Global Food Security Index and Global Hunger Score of Nepal

Nepal ranks 82nd out of 113 countries scoring 42.9 Global Food Security Index value (EIU, 2016). The score for Global Hunger Index of Nepal is decreasing year after year from the year 2000 to 2018 (35.5 to 21.2%). However, Nepal is suffering from a serious level of hunger in the global hunger map. Nepal rank 72nd out of 119 qualifying countries with scoring 21.2, in Global Hunger Index (2018) (Figure 1).

Seven of the districts in mid-western and western development region including Kathmandu valley was

indicated severely food deficit, 13 districts including one from Terai indicated food deficit and 7 marginally food deficit districts in the year 2011. Only the rest of the districts are in food surplus category with 5 marginally surplus districts (NeKSAP, 2012). It shows that Nepal is one of the food insecure countries having hunger with poor people in some geographical areas (Figure 2).



Source: NeKSAP, (2012)

Figure 2. Food Self Sufficiency by Districts in Nepal, 2011

Global food recommendation and Nepal food consumption trend

Per capita daily and yearly food requirement that includes cereals, pulses, green vegetables, tuber, roots, other vegetables, fruits, milk, meat, fish, eggs, sugar and honey, and fat and oils are recommended as per given in Table 1 (ICMR, 1985 ; WHO, 1986).

Nepal does not have such per capita food recommendation. Based on the ICMR and WHO recommendations, Nepal is deficit on majority of food items except eggs, Tea and Coffee. Nepal's import capacity seems in increasing trend. Nepal Food Corporation is the authority for the food stocks in Nepal. World Food Program (WFP) had provided food aid in different districts in each year (NeKSAP, 2012; WFP, 2015). Moreover, the Import Dependency Ratio (IDR) on total food products was only 15.4% with 15.8% on vegetable and only 1.5% in animal products in the year 2011. Whereas, the food Self Sufficiency Ratio SSR for total food products in Nepal was 88.6% with 88.3% on vegetable products and 99.7% on animal products in the same year as calculated from the government data (MoAD, 2013).

Table 1. Per-capita food recommendation

Food group	g/person/day	kg/person/year
Cereals	525.00	183.00
Pulses	67.50	26.00
Green vegetables	112.50	41.00
Tuber and roots	87.50	32.00
Other vegetables	87.50	32.00
Fruit	30.00	11.00
Milk	150.00	55.00
Meat and fish	30.00	11.00
Eggs	30.00	11.00
Sugar and honey	42.50	16.00
Fat and oils	42.50	16.00
Total	1205.00	432.00

Household food expenditure patterns and the share of expenses on food sub sub-groups in rural and urban areas in Nepal also found different. The percentage shares in total food expenditure in the year 2010-11 was found highest for cereals followed by animal products and away foods. Food expenditure for cereals was comparatively high in rural community and was lower for pulses, animal products, fruits, vegetables and away foods in the last decade in Nepal (MoAD, 2016). Thus, Nepal needs to have its own per capita food recommendation to target the food availability, balance and consumption.

Trends in food base nutrition

There is increasing trend of food energy available and consumption in Nepal MoAD (2016 and 2013). However, the source of food energy calories/capita/day, 2008-013 is in decreasing trend with cereals and vice versa with non-cereals especially from animal products, fruits and vegetables which is a good indicator on food consumption. The average per capita calories consumption during the year 2008-2013 found 2830 kcal in Nepal and is on upper side than the WHO recommendation (2220 kcal). The source of calories from cereals is 65% predominantly from rice, maize and wheat. However, the calories (kcal) intake in Nepal is comparatively higher in rural communities than in urban areas. Calories uptake found highest with the richer people and was more than 4000 kcal in rural and up to 3300 kcal in urban communities. Whereas it was less than 2000 kcal with poorer households as indicated by the ministry (MoAD, 2016).

Per capita consumption of protein is also on increasing trend with the growth rate of 2% in Nepal. However, the source of protein and protein consumption (protein/capita/day) from 2008 to 2013 was in decreasing trend with cereals (0.6%) and vice versa with non-cereals especially from animal products (5.7%). The trend is most progressive with edible oil and pulses consumption. The average per capita protein consumption during the year 2008-2013 found 72g/capita/day in Nepal and is in lower level than the level recommended by World Health Organization (WHO). The source of protein is mainly from cereals 60% predominantly from rice, maize and wheat. Similarly, the per capita fat consumption is also in increasing trend with the growth rate of 3.3% in Nepal. However, fat consumption g/capita/day from 2008 from 2013 was on decreasing trend with growth rate of cereals (0.4%) and vice versa with non-cereals (4.1%) (MoAD, 2016). The growth rate was most progressive for milk and dairy products with 8.0% growth rate, for edible oil 3.3% and for pulses 9.4% consumption. The average per capita fat consumption during the year 2008-2013 found 57 g/capita/day in Nepal (MoAD, 2018) and is in lower than ICMR and WHO recommendations. The source of fat is mainly from non cereals 81%, predominantly from edible oils 46%, milk and dairy products 18% and meat 8%. Among cereals, maize provides considerable quantity of per capita fat consumption which is 9% (MoAD, 2016). Moreover, there is double burden of women nutrition in Nepal. Women under-nutrition is declining 28.3-18.2% but over-nutrition is increasing 6.5-13.5% from 1996 to 2011. The problem of maternal over nutrition has been increasing more severely in recent time mainly in urban areas (MoAD, 2016). Thus, it is urgent to balance on the availability and consumption of all major nutrients including food energy, protein and fat. Also the sources of food from animal and plant in our diet should be balance irrespective to gender and geography.

Food production and balance in Nepal

National food production and balance

Cereals area coverage in the year 2017/018 was 3,463,293ha and the gross production was 9,728,382 t (MoAD, 2018) in Nepal. The productivity of milled product available for table consumption seems to be 2.09 t/ha with 7,252,657t cereals food available. Area coverage, gross production, availability and productivity of milled foods like pulses, vegetables, potato/tubers, fruits, spices, sugar, oilseed/ghee, honey, tea and coffee, meat, fish, milk (including cattle and buffalo), and eggs are given in Table 2.

Based on the available statistics the per capita consumption of cereals in Nepal was 191 kg which was higher than WHO and ICMR recommendations (186 kg/person/year). The per capita consumption of potato and tubers was at par the recommendation. However, the per capita consumption of pulses, 11.5 versus 26kg; vegetables, 76 versus 100kg; fruit, 17 versus 30kg; sugar, 10.9 versus 16kg, and oil and fat, 4 versus 16kg, were comparatively lower than WHO and ICMR recommendations in the year 2017/018 in Nepal (Table 3). This showed the imbalance food consumption pattern in Nepal. The yearly deficit of the cereal grains in Nepal in the year 2017/018 was 578,343t. However, it was only 196,440t deficit by the WHO and ICMR recommendations. Moreover, the food consumption specially pulses, vegetables, fruits, sugar, oilseed/ghee, honey, meat, fish, and milk (including cattle and buffalo) seems insufficient compare the recommendations. Consumption of potato/tubers and eggs were as par the recommendations (MoAD, 2018). There lacks the recommendation for tea and coffee and spices. The

huge deficit of different foods in Nepal can be met either by area/herd size expansion or rising the crop/livestock productivity mentioned in Table 3 or have to depend on the imports as usual.

Table 2. National food production

Commodity Consumable	Area (ha)	Gross production (t)	Production Milled (t)	Productivity Milled (t/ha)
Cereals	3463293	9728382	7252657	2.09
Pulses	326055	378196	283500	0.87
Vegetables	277393	3749802	1874901	7.00
Potato/tubers	199971	2805580	2525022	12.60
Fruit	110501	1018308	1018308	9.22
Spices	97327	66817	66817	0.69
Sugar	78609	3558182	284655	4.07
Oilseed/Ghee	207978	214451	75058	0.36
Honey	232000 hives	3500	3500	15.00 kg
Tea	38241	24409	24409	0.64
Coffee	2618	532	203	0.08
Meat	-	347000	242900	-
Fish	9934+captured	77000	53900	4.87
Milk (Cattle, Buff)	1811320	2045000	2045000	1.15
Eggs	6667950	1470000000	1470000000	220.00

Note: Source of data for crop area and production and livestock population and production are from Ministry of Agriculture and Livestock Development

Table 3. National food balance 2017/018 Nepal population: 28,431,494

Commodity	Per capita consumption (kg/yr)	Per capita Recommendation (kg/yr)	Yearly consumption (t)	Yearly requirement (t)	Yearly deficit by consumption (t)	Yearly deficit by recommendation (t)
Cereals	191	186	7831000	5288258	578343	196440
Pulses	11.5	26	327452	1066000	43952	782500
Vegetables	76	100	2156136	2843149	281235	968248
Potato/tubers	100	100	2843149	2843149	318127	318127
Fruit	17	30	4833354	8529448	3815046	7511140
Spices	3	3	123000	123000	56183	56183
Sugar	10.9	16	310000	454906	25345	170251
Oilseed/Ghee	4	16	113726	454904	38668	379846
Honey	-	-	6150	14215.75	2650	10715.75
Tea	-	-	12709	12709	+11700	+11700
Coffee	-	-	125	125	+78	+78
Meat	122	14	341178	398041	98278	155141
Fish	7	11	199020	312746	145120	258846
Milk (Cattle/ Buff)	72	91	2047068	2587266	2068	542266
Eggs	51	48	1470000000	1364711712	0	+105288288

It seems that the productivity of different crop and livestock products in Nepal is very low and the consumption pattern is also not balanced and uniform throughout the geography.

Availability and sufficiency of milled cereals

Per capita cereals requirement in Nepal is estimated at 89 kg, 45 kg maize, 45 kg wheat, 10 kg millet, 1kg buckwheat and 1 kg barley. Total per capita consumption of cereals in the year 2017/018 was 191 kg/person, with the total consumption of milled cereals 78,31,000 t (MoAD, 2018). However, the total requirement as per the WHO and ICMR recommendations seemed to be only 52,88,258 t annually (Table 3).

The future strategy for the national cereals self sufficiency needs expansion of spring rice area by 93,990 ha and the equal area of winter maize to meet the national deficit. Alternatively, raising national cereals productivity only by 0.2 t/ha can also meet the target of self sufficiency. Moreover, provision of the incentives to farmers for additional paddy production/ha also can help to raise the productivity (MoAD, 2018). Use of hybrid rice and maize varieties, preventing illegal export of paddy from Terai to India, collection and storage about 7,00,000 t paddy grains/year in season as the buffer stock are also important way to solve the problem. Support on infrastructure, provision of drying of spring maize and early paddy and support on farm inputs are also important. Increased consumption of potato and minor crops also can discourage rice culture. However, increasing the area of spring rice and winter maize with increasing over all cereals productivity, together with preventing illegal export and maintenance of buffer stock of paddy are only the solutions to have cereals self sufficiency in Nepal

Availability and sufficiency of milled pulses

Lentil, black grams and similar other pulses are common on different geography in Nepal. National consumption of pulses in Nepal in the year 2017/018 was 3,27,452 t. In fact, the consumption of pulses in the country is quite less than the ICMR and WHO recommendations which should be 1,06,600 t annually. Nepal produced 2,83,500 t milled pulses in the year 2017/018. Thus, Nepal was deficit by 43,952t milled pulses by the consumption and 7,82,500t deficits by the ICMR recommendation in this year (Table 3).

Future strategy to meet the deficit can be expansion of pulses area or raise the productivity. To meet the national demand it needs the expansion of pulses area by 9,00,460 ha which is almost not possible. Alternatively, increasing the productivity by 0.32 t/ha, throughout the country also can meet the national deficit by 12.0% (MoAD, 2018). Increasing the productivity beyond this is very hard. So, there is a need of the combined effort for both area expansion and raising the productivity. It should be further back up by the immediate action for maintaining the buffer stock of 50% of national deficit of 3,91,250 t in major cities of Nepal. Emphasis shall be given to alternative protein sources like fish and animal sources that can substitute the pulses. Provision of output based incentives to farmers for additional yield, construction of ware houses for maintaining least 50% deficit as the buffer stock, support on mills and other inputs can enhance the pulses sufficiency in a sustainable way**.** Increasing the per capita pulses consumption as per ICMR (1985) recommendation is possible either from increased production or from import. We do have 3rd option to replace pulses from increased consumption of fish and animal products.

Availability and sufficiency of kitchen supplied vegetables and spices

People in Nepal consumed 21,56,134 t kitchen supplied vegetables in the year 2017/018. The consumption was lower than the ICMR and WHO recommendations. In fact, the consumption should have been 28,43,149 t as per the recommendations. The national production of kitchen supplied vegetables in Nepal in the year 2017/018 was 18,74,901 t (MoAD, 2018). Thus, Nepal was deficit by 2,81,235 t from consumption and by 9,68,248 t by recommendation (ICMR, 1985) in the year 2017/018. In addition to these, the consumption of spices in Nepal was 1,23,000 t in the year 2017/018. Where, the national production was only 66,817 t (MoAD, 2018). Thus, Nepal was deficit by 56,183 t spices in this year (Table 3).

Future strategy to meet the self sufficiency is either expansion of vegetable and spices area or raising their productivity. The sufficiency of kitchen supplied vegetables in the nation needs 1,38,321 ha area expansion or raising productivity by 3.49 t/ha across the country. The data was calculated based on the government statistics (MoAD, 2018). Moreover, for the sufficiency of species, it needs 81,425 ha area expansion or raising productivity by 0.58 t/ha. The production program shall be back up by the establishment of high tech green houses and developing at least 3 whole sale markets provision with grading, packaging, rapid pesticide testing (RPT) facilities. These markets shall be handling by cooperatives and linked with national and international (China) whole sale markets. Immediate action should be taken to maintain cold chain and capacious cold storages across the country. Thus, Nepal can be self sufficient on vegetable and species production with a small effort on raising the productivity or increasing cultivated areas. However, it needs to strengthen the marketing system and infrastructures.

Availability and sufficiency of kitchen supplied tubers/potato

The consumption of potato in Nepal is as par the WHO and ICMR recommendations. It was 28,43,149 t in 2017/018. National production of kitchen supplied potato/tubers in this year was 25,25,022 t (MoAD, 2018). This seems that the tubers deficit in this year was only 31,817 t (Table 3). Thus, balancing the import and export with improved production and marketing system can easily achieved the self sufficiency of potato/tubers. Future strategy for the sufficiency of potato needs area expansion by 25,248 ha with an increase of productivity by 1.59 t/ha which can be easily achieved. However, establishment of high tech hydroponic houses for producing PBS, tissue culture labs, strengthening seed system, develop whole sale provincial markets provision with grading, packaging and RPT facilities, maintenance of cold chain and capacious cold storages are necessary. The whole sale markets shall be handled by cooperatives and linked with national and international markets. Thus, Nepal can be self sufficient on potato tubers with a small effort by raising the productivity or increasing the cultivated areas a bit more with strengthening the seed and marketing system and the infrastructure supports.

Availability and sufficiency of table fruits

The consumption of table fruits in the year 2017/018 in Nepal was 48,33,354 t. The volume consumed in this year was far lower (56.7%) than WHO and ICMR recommendations (calculated 85,29,448 t/year). The production of table fruits in Nepal in the same year was only 10,18,308 t (MoAD, 2018). The deficit of this year was 38,15,086 t on consumption and 75,11,140 t as per ICMR recommendation (Table 3). The deficit was dominantly on apples, grapes, oranges, mango, pomegranate, lemon and nuts, imported from aboard. The future strategy for the sufficiency of fruits in Nepal needs massive area expansion of sub tropical and sub temperate fruits by 8,14,657 ha across the feasible sites. Alternatively, it can be met from raising productivity of fruits by 7.37 t/ha in national base, which are almost impossible in a short period of time. However the combined target of raising productivity by 2.0 t/ha combined with the area expansion of ha 4,00,000 ha can also make the country self sufficient on fruits. Moreover, the synergy can be given from establishment of high tech green houses for fruit nurseries and high density fruit orchards in country sites. Development of provincial whole sale markets provision with grading, packaging and RPT facility, that is handling by cooperatives and linked with other national and international (China) whole sale markets are most important. Immediate action to maintain cold chain and capacious cold storages in country sites are equally important. For this, increased investment is needed. Thus, an widen expansion of fruit areas supported with high density, high tech nurseries and fruit gardens with ample infrastructure supports are recommended.

Availability and sufficiency of sugar

The national consumption of sugar in Nepal was 3,10,000 t for the year 2017/18 . The consumption was in lower side and it would be 4,54,906 t based on WHO and ICMR recommendations. Sugar production in Nepal in the same year was 2,84,655 t (MoAD, 2018). So, the deficit of sugar in this year was by 25,345 t on consumption and was 1,70,251 t as per the WHO recommendation (Table 3). The future strategy for the sugar sufficiency in Nepal covers area expansion or to raise the sugarcane productivity or the combination of the both. It needs area expansion of 41,831ha in the feasible sites. Alternatively, it needs to raise the sugar productivity by 2.17 t/ha which at present seems too hard. So the combination of the both can give the synergy to meet the national sugar self sufficiency. Moreover, the program can be synergized with the maintenance of 50% (85,126 t) deficit as the buffer stock in provincial capitals, in each year. Improve relationship between cane farmers and mills extension on cane buying and payment, increase custom duty up to 50% on sugar import and band on sugarcane import are equally beneficial for the domestic farmers, millers and consumers. There is a strong possibility of sugar self sufficiency and export promotion in Nepal. It needs expansion of sugarcane area, combined with raising the productivity, stopping the import of cane and sugar in the country and improved payment on cane buying.

Availability and sufficiency of edible oils and fats

The consumption of edible oils and fat in Nepal in the year 2017/018 was 1,13,726 t. It seems the people in Nepal consume lower amount of edible oils and fats than WHO and ICMR recommendations. It requires 4,54,904 t edible oils and fats annually as per the recommendation. Production of edible oils and fat in Nepal in the same year was only 75,058 t (MoAD, 2018). Thus the deficit of edible oils and fat in Nepal in this year was 38,668 t by consumption and by 3,79,846 t by WHO and ICMR recommendations.

Future strategy to meet the national sufficiency covers raising the productivity of oil seeds by 1.83 t/ha which is not possible at once. Alternatively, increasing oilseed area by 10,55,128 ha on national base can serve the purpose, which is also not feasible. Thus, combination of both efforts seems best alternative to minimize the imports.

In addition, maintenance of buffer stock of 50% deficit (1,89,923 t) in provincial sites and improve regulation to prevent the adulteration and quality control are also important. However, the per capita consumption of oils and fats in Nepal is very low because of its serious deficit on production. Area expansion of oil seed or increasing the productivity with judicious import and buffer stocking are necessary to increase the per capita consumption.

Availability and sufficiency of honey

The consumption of table honey in the year 2017/018 in Nepal was 6,150 t (MoAD, 2018). There lacks the recommendation on honey consumption. However, the per capita consumption of table honey if assume to be 0.5 kg/person/year, the requirement of honey in Nepal shall be 14,216 t/year. The production of table honey in the year 2017/018 in Nepal was 3,500 t (MoAD, 2018). Thus, the deficit of table honey in Nepal shall be 2,650t from actual consumption and 10,716 t as per estimated per capita recommendation (Table-3). Strategically, it needs establishment of 1,429 large size new apiaries each having at least 500 colonies for the sufficiency of table honey in Nepal (Pokhrel, 2015). Alternatively, it needs to raise productivity by 46 kg honey/hive/year on national base which is very hard to meet. However, we can meet 21% of national deficit by raising honey productivity by 7 kg/hive/year. So the combined program of establishing new apiaries or enlarging the apiary sizes together with improved management practices for rising the productivity are recommended. In addition, establishment of collection, processing, packaging, storage and transportation infrastructures are also needed. Product diversification with an increased domestic consumption by the persons in army, police, school children and house hold families with improved marketing, linked with international markets are also important. These activities can help to substitute the import and enhance self sufficiency of table honey in Nepal.

Availability and sufficiency of tea and coffee

The consumption of fine tea in Nepal was 12,709 t for the year 2017/18 (NTCDB, 2018). Nepal produced 24,409 t tea in this year. Thus Nepal is already self sufficient in tea and the balance is positive by 11,700 t annually. Moreover, the consumption of coffee in the year 2017/018 in Nepal was 125 t. National production of table coffee in this year was 203 t (NTCDB, 2018). So, Nepal is self sufficient and positive on coffee balance by 78 t annually. A total of 11,745 t tea and 9.5 t coffee was exported in the year 2017/018 from Nepal. The total import of tea in this year was equivalent to NPR 9,06,56,000 and coffee NPR 8,45,39,000 in this year (NTCDB, 2018).

Nepal needs to emphasized on tea and coffee high tech nurseries, plantation and orchard management, establishment and strengthening the tea and coffee processing plants, strengthen the collection and distribution system, establishment of international and national e-auction centers, and maintain quality standards for the promotion of domestic and export tea and coffee markets. Nepal can double the present export of tea either by the new plantation on 1,8281 ha and coffee on 2,618 ha or by increasing the productivity of tea by 0.31 t/ha and coffee by 0.02 t/ha. However, the combined program for new plantation and increasing the productivity with quality production are recommended (Table 3).

Availability and sufficiency of meat

The national consumption of meat in the year 2017/018 in Nepal was 3,41,178 t with the proportion of Buff 65%, mutton 20%, pork 7% and chicken 8% (MoAD, 2018). The consumption was slightly lower than the ICMR and WHO recommendations which becomes 3,98,041 t/year. The meat production (Buff-65%, Mutton-20%, Pork-7% and Poultry-8%) in Nepal in the year 2017/018 was 2,42,900 t (MoAD, 2018) and was deficit by 98,278 t by actual consumption and 1,55,141 t up on ICMR recommendation (Table 3). The demand of meat in Nepal is increasing by 10% annually (MoAD, 2018)

Based on the ICMR (1985) recommendation, Nepal can meet the meat sufficiency by establishing about 6,468 new buffalo fattening farms (heard size 100 @ 400kg/head), 5,307 goat farms (heard size 500 @ 30kg/head), 279 piggery (heard size 500 @200kg/head) and 3,184 poultry farms (heard size 50,000 birds @ 2kg/head) across the country. However, increasing the present farm sizes combined with raising the meat productivity through improving management practices also can help to increase meat availability and consumption.

Availability and sufficiency of culture and capture fish

The national consumption of both captured and cultured fishes in Nepal in 2017/018 was 1,99,020 t (MoAD, 2018). As per the recommendation of WHO and ICMR the volume seems to be higher (3,12,746 t) (WHO, 1986; ICMR, 1985). Production of pond fishes in 2017/018 in Nepal was only 9,935 t. However, the statistics on river capture fishes is not available (MoAD, 2018). Thus, Nepal deficit on fishes by 1,45,120 t by the present consumption and 2,58,846 t by ICMR/WHO recommendations (Table 3). The growth rate of fishery sector is 14%

in Nepal and the demand is increasing by 15% annually (MoAD, 2018). The protein malnutrition in the country can be solved from fishery and is the cheep source of protein than the pulses and other animal sources.

The future strategy to have sufficiency of fish in Nepal needs to establish new fish farms in 53,151 ha at national base and there is a threat to replacing productive rice fields. Increasing productivity alone of 4.51 t/ha can also meet the national demand which seems not possible at once. Therefore, combination of both the activities on expansion of fishery area and raising the productivity is recommended. Moreover, maintaining scientific/judicious catch from the rivers and natural ponds is also equally important. Establishment of additional hatcheries and feed industries can give the synergy.

Availability and sufficiency of milk (buffalo and cattle)

Milk consumption in the year 2017/018 in Nepal was 20,47,068 t (MoAD, 2018). According to the recommendation of ICMR (1985), the quantity should be higher than this (25,87,266 t). National milk production in the same year was 20,45,000 t (MoAD, 2018). Thus, the annual deficit of milk seems only 2,068 t by consumption and 5,42,266 t by recommendation in Nepal (Table 3). Moreover, the milk demand in Nepal is increasing by 8% annually (MoAD, 2018).

Future strategy for the milk sufficiency in Nepal can be through establishing new dairy farms or from raising the milk productivity. For the milk sufficiency in Nepal it needs either establishment of 4,715 new dairy buffalo/cow farms with at least 100 dairy animals/farm across the provinces or to increase the national milk productivity by 0.3 t/year/cow or buffalo or the combination of the both. This should be supported by improved milk collection processing/packaging and distribution/marketing systems and improved husbandry management practices throughout the country.

Availability and sufficiency of poultry eggs (chicken and ducks)

The consumption of poultry (chicken and ducks) eggs in Nepal was 1470 million pieces in the year 2017/018 (MoAD, 2018). However, the consumption of eggs in Nepal was slightly higher than the ICMR (1985) and WHO (1986) recommendations, which comes to be only 1364.7 million pieces. The production of poultry eggs in Nepal in the same year was 1470 million pieces (MoAD, 2018). Thus, Nepal is annually self sufficient on poultry eggs by consumption and is balance by 85.3 million pieces as per the ICMR recommendation (Table 3). The demand of poultry eggs in Nepal is increasing by 8% annually (MoAD, 2018).

Strategically, Nepal should think on preventing the import and export promotion of poultry eggs beyond the self sufficiency. It needs establishment of 500 additional large poultry farms (50,000 birds/farm) and raise poultry egg productivity by 25 eggs/bird/year across the country for to initiate the export. It should back up from sufficient infrastructure support feed hatchery and veterinary services. However, the export market needs to be identified at advance.

Self Sufficiency Ratio (SSR) and Import Dependency Ratio (IDR) of foods in Nepal

Nepal is self sufficient on tea coffee and poultry eggs. The self sufficiency ratio of cereals in the year 2017/018 was 97.4% with the share of 2.6% import only. Vegetables (65.9%), potato (88.8%), milk (79%), sugar (62.6%), and meat (61%) have more or less about two third SSR and having about only one third IDR. Spices (54.3%) have more over intermediate SSR. The SSR in 2017/018 of pulses (26.6%), honey (24.6%), fishes (17.2%), oilseeds (16.5%), and fruits (11.9%) were comparatively very low and Nepal was depended mainly on imports (Table 4).

Table 4. IDR and SSR of foods in Nepal

Commodity Consumable	Production Milled (t)	Deficit/surplus (t)	Total (t)	SSR Prod. %	IDR Deficit %
Cereals	7252657	196440	7449097	97.4	2.6
Pulses	283500	782500	1066000	26.6	73.4
Vegetables	1874901	968248	2843149	65.9	34.1
Potato	2525022	318127	2843149	88.8	11.2
Fruits	1018308	7511140	8529448	11.9	88.1
Spices	66817	56183	123000	54.3	45.7
Sugar	284655	170251	454906	62.6	37.4
Oilseed	75058	379846	454904	16.5	83.5
Honey	3500	10715.75	14215.75	24.6	75.4
Tea	24409	+11700	-	100.0	0.0
Coffee	203	+78	-	100.0	0.0
Meat	242900	155141	398041	61.0	39.0
Fish	53900	258846	312746	17.2	82.8
Milk	2045000	542266	2587266	79.0	21.0
Eggs	1470000000	+105288288	-	100.0	0.0

DISCUSSION

The agricultural development is the fundamental for sustainable development and poverty alleviation in the developing countries. Besides, being the primary source of food and contribution in the household economy, agriculture holds major share in providing the raw materials for industries and the national economy too (Dhital, 2017). Many of the countries in the world are not self sufficient in all the food they consumed and they fulfill the deficit by improved production or from imports. Japan's Ministry of Agriculture, Forestry and Fisheries reported that Australia, United States and France were the major countries having highest food self-sufficiency rates (MoAFF, 2010). However, FAO reported that Argentina, Uruguay and Australia secured the highest self-sufficiency ratio and Dominican Republic, Armenia and Zimbabwe are the countries with lowest self sufficiency ratio (FAO, 2012). United Kingdom was the country once producing all of its food domestically. But, as tastes evolved and shipping became cheaper more food started to come from abroad. United Kingdom imports 38 percent of all food they eat (Stone, 2014). India claimed to have food self-sufficient on plant products in recent decades and is trying to be self sufficient on animal and dairy products. In fact, India is also importing plenty of food stuffs including pulses from different countries (Sushma, 2018; Rediff.com, 2011). Similarly, Nepal is also not independent to foods on its own production. At present, Nepal is self sufficient only on tea, coffee and poultry eggs. However, the self sufficiency ratios (SSR) of cereals (97.4%), vegetables (65.9%), potato (88.8%), milk (79%), sugar (62.6%) and meat (61%) are still higher and there is ample scope to be self sufficient. Moreover, the import dependency ratio (IDR) of certain commodities like fruits (88.1%), oils (83.5%), fish (82.8%), and pulses (73.4%) are very high and is increasing year after years. It is very hard to meet self sufficiency on these commodities because of their insufficient area coverage/ herd sizes, lower productivity and longer gestation period required. However, an increased productivity of cereals by 0.06 t/ha, vegetables 3.49 t/ha, potato/tubers 1.59 t/ha, spices 0.58 t/ha, milk 0.30 t/head/yr, and a considerable increment of meat productivity can make the country self sufficient. Moreover, the food education is needed to improve our food consumption and nutrient uptake pattern and balancing our diet (NeKSAP, 2012). India has its own per capita diet/food recommendation (ICMR, 1985). However, Nepal lacks food/diet recommendation. The per capita consumption of energy in Nepal is very high with lower uptake of protein and edible oil/fat. It seems the source of our food is mostly from plant sources dominated by cereals (NeKSAP, 2012). It needs to decrease the cereals mostly the rice and increase the consumption of pulses, fruits, vegetables, milk, meat, fish, oil and fats (ICMR, 1985; MoAD, 2018).

Many nations have their own food policy and regulation for the strong availability, food sufficiency, food trade control, better nutrition and health of the citizens and to make farmers' livelihoods better (Sushma, 2018). United States have well adopted food policy with the strong food regulation, that covers agriculture production, agriculture and the environment, food and agricultural trade, food manufacturing, food retailing and restaurants, food safety, dietary guidance and health food labeling and advertising, hunger and food insecurity, and nutrition

assistance for children (Wilde, 2018). India also has a separate foreign trade department with a network of its regional offices functioning under the Ministry of Commerce, working on food trade and regulation. India has augmented its food and processing industry at a mega scale that supported both production and food availability (Rediff.com, 2011). Nepal committed for food and nutrition security, right to food, food sovereignty, and zero hunger initiative. Department of Food Technology and Quality Control is placed for food quality control and Ministry of Supply is in place for to insure food supply. However, the coordination between the food production, processing, quality regulation and supply system seems not strong enough. It is most important to have a food policy reform in Nepal for strengthening food production system for domestic consumption import substitution or for export promotion or to support the food industries from supplying the raw materials. Rice consumption shall be minimize or substituted from other foods like potato wheat and maize. Food import shall be continuing if we do not have the alternatives. The illegal export of paddy and other cereals from Terai boarder just after their harvesting is frequently reported from Nepal. So it needs to stop and maintain at least 50% food deficit as buffer stocks and stop cane/sugar import to restore national food sufficiency in Nepal (Pokhrel, 2020).

The overwhelming majority of global staple foods are grains. Maize/corn occupies number one staple food in the world (19.5%) followed by rice (16.5%), wheat (15.0%), cassava (2.6%), soybeans (2.1%), potatoes (1.7%), sorghum (1.2%), and other minor crops (sweet potato, yams and plantain) (Pariona, 2019). In Western Europe the animal products (33%), cereals (26%) and roots and tubers (4%) are the staple foods (Boyle, 2016). In South Asian countries such as Bangladesh and Myanmar people derive 90% or more of their calories from rice alone (Pariona, 2019). However, culture climate and trade are all factors that determine the popularity of a certain food. But, at recent the staple food and the food habit are changing in the globe. Typical American meals have gone through a significant shift from wheat to fish cereals/rice, pizza, teriyaki chicken, pho and fast foods like sandwich and burger with fries in recent years (Alexander, 2015). Rice is the staple food in Nepal. The per capita consumption rate of cereals mainly the rice is very high compare the recommendation of ICMR (1985). The import of rice especially fine rice is increasing tremendously in recent years. Thus, there is a need of changing food habit to minimize the rice consumption and balancing the calories uptake (Pokhrel, 2020). Throughout ages, many rituals have been associated with the cultivation of neglected and underutilized crops and livestock in different geography of the globe (Sushma, 2018). There are a number of land races wild vegetables, fruits and animals that can be domesticated and use. It is true in case of Nepal too. Increased calories uptake can be reduced by the increased consumption of these neglected foods, non cereals and the animal products. Rice consumption can also be minimized from the consumption of potato, wheat and other cereals. Food diversification from nutritious local foods can also be the alternatives substitute of rice in Nepal (Pokhrel, 2020).

Countries like the US, China and Brazil either have larger land masses or they are part of bigger economic unions have scope for the expansion of the cultivated areas and herd/farm sizes for the commercial production (Sushma, 2018). In Japan, municipalities prepare the land-use plans in accordance with national and prefectural laws and regulations and pass auxiliary regulations guiding land use in their jurisdictions (OECD, 2017). Where, the land use policies are supported for the expansion and commercial production of livestock and pasture use in Hokkaido and for paddy, soybean, onion, wheat, barley, sugar beet and starch potato on rest of the uplands. The priority has been given based on their competitive price, domestic demand, soil health and industrial use (OECD, 2009). However, the change on land use for the commodities in USA is made on the basis of a complex set of factors including commodity prices; market forces; production technology; government policies and the returns from it (Cynthia & Borchers, 2012). But, the available land is limited and cannot expand without reducing the area of another commodity in many of the countries. The expansion of the cultivated areas/herd size is not feasible for all the commodities in Nepal too. Thus, it needs to prioritize the commodities to allocate the cultivated land areas for crop farming, fish ponds, apiary or the livestock farm or pasture. Moreover, establishment of large size, high tech farms like buffalo fattening farms, goat farms, piggery, poultry farms, apiary, fish farms, high density fruit orchards and commercial organic vegetable farms in rural community is necessary to feed the even growing city population and achieve national food sufficiency. It can also generate rural employment and income for the economic resilience.

Increased productivity results in to the rise in farm incomes and fueling the linkages between farm and non-farm poverty reduction programs, which are the consequences of agricultural growth (Dhital, 2017). The productivity of cereals (2.8 t/ha), pulses (1.2 t/ha), vegetables (13.5 t/ha), potato/tubers (14.0 t/ha), fruits (9.2 t/ha), sugarcane (45.3t/ha), oilseed (1.0t/ha), honey (15 kg/hive), tea (0.6 t/ha), coffee (0.2 t/ha), milk including cattle and buffaloes (1.1 t/ha) and eggs (220.5piece/bird) are comparatively very low in Nepal (MoAD, 2018). Where, the average cereal productivity in the world is 4.0 t/ha (The World Bank Group, 2019), vegetables 13.9 t/ha and fruits

12.04 t/ha (FAO, 2010). The crop and animal productivity in several other countries are very high. The productivity of corn alone in USA is 10.07 t/ha (Wikipedia, 2020).Where, the vegetables yield was 31.3 t/ha (Knoema, 2018) and the cereals yield 5.5 t/ha (Martin, 2018) in Denmark in the year 2018. In addition, the average dairy farm has 160 cows and the average milk yield per cow was 10,300 kg/yr in Denmark in the year 2015 (Henrik, 2015). In Nepal, an increased productivity of cereals by 0.06 t/ha, vegetables 3.49 t/ha, potato/tubers 1.59 t/ha, milk 0.30 t/head/yr and a considerable increment of meat productivity can make the country self sufficient. But, the food productivity can only increase with a strong research and technical back up, technology, infrastructure, funding support and an enabling environment. However, it cannot increase beyond a limit. So, for restoring the food self sufficiency it needs a combined effort with the scope of area expansion with predominantly an increase in food productivity.

Global food and nutrition security cannot be adequately addressed without the participation of the research community. The research focus on developing high yielding breed and varieties, with reducing the food waste at all stages and reduced negative environmental impacts in the food chain and food safety can enhance food sufficiency (EU, 2015). Different countries are adopting modern and advanced technologies for to secure food security. USA has led developments in seed improvement, such as hybridization, breed improvement, farm mechanization and intensive farming and shifted from hobby farms and small-scale producers to large commercial farms covering thousands of acres of cropland or rangeland (Wilde, 2018). Farmers in India also are benefitting from the advanced technologies to increase their yields from farming and livestock rearing. It includes the use of sensors and digital tools, farm mechanization, use of quality seeds, proper irrigation, chemical fertilizers and pesticides use (Sharma & Mungrawal, 2019). However, use of high tech agriculture is still is not advanced in Nepal that could led the country toward self sufficient in many of the agriculture commodities.

Infrastructures are basic things for modernizing the agriculture. Community refrigerators have helped reduce food wastage in the UAE, Germany and France (Sushma, 2018). Many other countries having higher animal and crop yield like USA and India have developed, popularized and scaled up the high tech initiative for higher and quality yields (World Bank Group, 2020). Similarly, Nepal needs to develop sufficient irrigation structures, farm structures, custom hiring centre, community storage, cold storage and cold chains, high tech nurseries/green houses and farms, collection/processing/packaging units and the market structures to restore the food self sufficiency in the country.

Recent commitments of the African countries like Ghana, Ethiopia and Rwanda devoted larger shares of government budgets and attracted new private investment on agricultural Input Subsidy Programs (ISPs) in the last decade. The ISPs have raised the rate of purchasing agriculture inputs including fertilizer in prior seasons and has improved national food production and farmer's income (Food Tank, 2018). There are public subsidies on agriculture production inputs like improve seeds, fertilizers and machineries in Nepal too. However, the accesses of local farmers on these inputs are frequently questioned.

Many of the countries in the globe are not self sufficient in all the food they consumed. Germany, UK and Italy are importing a number of food commodities from Netherlands (Sushma, 2018). India is one of the biggest producers of sugarcane, fruits, vegetables, animal and dairy products in the world. However, the imports demands of India are rising faster because of the sharp decline in per capita food availability and the population pressure (Rediff.com, 2011). Pulses are the example being imported into India each year (Sushma, 2018). Sugar and confectionary, dried vegetables, coffee, tea and spices, dairy products, honey, cereals, fruits (nuts apples and dates), and edible oils are other major importing commodities in India (Rediff.com, 2011). Thus, Nepal also needs to determine the commodities to be self sufficient from own production or depend on import, fully or partially. However, the production sites, countries, quality and quantities to be imported shall be well defined with bilateral and multilateral agreement at advance. Buffer stocking of such importing non-perishables can only assured its availability round the year. There are a number of countries exporting crop and animal produce foods. Main exports of Guatemala are coffee and sugar; USA exports apples, corn, Ivory Coast and Benin export cashew nuts and Afghanistan exports dates (Rediff.com, 2011). Nepal is exporting coffee, tea and spices at present (MoAD, 2018). Australia, Denmark and New Zealand export dairy/animal products including eggs and honey. India exports fresh agriculture products like green vegetables, potato, onion, fruits (mango, apples) and dairy products to neighboring countries including Nepal, west Asia and East European markets (Rediff.com, 2011). Nepal shall further strengthen the export promotions program on coffee, tea and poultry eggs. The export shall be promoted on banana, sugar, green vegetables, herbs and NTFP.

Nepal shall have a commercial production programs on cereals, vegetables, potato, milk, sugar and meat for their national self sufficiency. It needs to raise cereals productivity by 0.06 t/ha, vegetables 3.49 t/ha, potato/tubers 1.59 t/ha, spices 0.58 t/ha, milk 0.30 t/head/yr and a considerable increment of meat productivity for the self sufficiency. For this, there is an immediate need to stop the import of these commodities. Moreover, the program shall be initiated to reduce the import dependency ratio (IDR) of fruits, oils, fish and pulses, through wide expansion of their cultivated area and their productivity.

For overall national development, there is a need of huge investment on agriculture (Birner & Anderson, 2007). However, funding on agriculture sector is in declining trend in Nepal (Dhital, 2017). There lacks integrated approaches on public-public partnership, majority private funds are mobilizing separately against public-private partnership and private-private partnership is also not materialized enough as projected by ADS. Thus, it is recommended to have improved agriculture funding through increasing public investment and attraction of the private fund for agriculture development in Nepal (Pokhrel, 2019). The short term farm subsidies on production inputs shall be continued by the Municipalities for improving the agriculture productivity. However, the long term agriculture subsidy that covers overall support framework, better infrastructure, research, knowledge dissemination, capacity building, market support, institutional strengthening, farmer's welfare scheme, insurance and agriculture risk reduction are important to be addressed to hold food self sufficiency and national food security (Pokhrel, 2020).

There is a need to replace the domination of supply driven agriculture extension approaches by the demand driven services (Birner & Anderson, 2007). The extension services based on more and more donor's interest and less concerned on the demand of farmers should be improved. The practice of privatization of the extension is not seen in Nepal (Dhital, 2017). A good demand driven extension service is possible when there is commercialization and privatization of the extension services (Birner & Anderson, 2007). Recent political transformation has brought changes on service delivery system in agriculture development in Nepal. Human resource development (technical) and training is a challenge for the Rural/Municipalities. Human resource development and extension reform are necessary to address the need of import substitution, restoring food self sufficiency and export promotion of the selected agricultural commodities. There are a number of emphasis based production projects like Prime minister Agriculture Modernization Project (PMAMP), Food and Nutrition Security Enhancement Project (FANSEP), implementing for the commercialization of agriculture in Nepal. These projects must play role to restore food self sufficiency in the country.

CONCLUSION AND RECOMMENDATIONS

Nepal committed for food and nutrition security, right to food, food sovereignty and zero hunger initiative through various legal documents. However, the country is classified as severe localized food insecure country ranking 82nd on Global Food Security Index. The food consumption and nutrient uptake pattern is not balanced in Nepal. Whereas, the per capita consumption of energy is very high with lower uptake of protein and edible oil/fat compare to ICMR (1985) and WHO (1986) recommendations. Moreover, there is double burden of women nutrition in Nepal. Under-nutrition is severe (18.2%) in rural and poor communities where over-nutrition (13.5%) is a problem in cities and richer families. The source of food is mostly from plant origin dominated by cereals. Where, consumption of pulses, fruits, vegetables, milk, meat, fish, and oil and fats are on lower rate (ICMR, 1985) though the consumption rate of these commodities are in slow increasing trend (MoAD, 2018).

At present Nepal is self sufficient on few commodities like tea, coffee and poultry eggs. However, the self sufficiency ratios (SSR) of cereals (97.4%), vegetables (65.9%), potato (88.8%), milk (79%), sugar (62.6%) and meat (61%) are still high and there is ample scope to be self sufficient. Moreover, the import dependency ratio (IDR) of certain commodities like fruits (88.1%), oils (83.5%), fish (82.8%) and pulses (73.4%) are very high and is increasing year after years. It is very hard to meet self sufficiency on these commodities because of their insufficient area coverage/herd sizes, lower productivity and longer gestation period required.

It is recommended to have effective food and nutrition education for improving the food consumption system. There is an immense need of reducing per capita cereals consumption and increase the non cereal foods especially pulses, animal products, fruits and vegetables to balance our diet as per the ICMR (1985) and WHO (1986) recommendations. Emphasis should be given on alternative staple foods like potato/tubers, wheat and maize to discourage the rice culture. Nepal shall be self sufficient in some of the agriculture commodities from raising their productivity. An increased productivity of cereals by 0.06t/ha, vegetables 3.49t/ha, potato/tubers 1.59 t/ha, spices 0.58 t/ha, milk 0.30 t/head/yr and a considerable increment of meat productivity can make the country self sufficient. In addition, expansion of the cultivated areas/herd size also can meet the purpose but it is not possible for all the commodities. It needs to prioritize them and give emphasis on raising the productivity. It is

also recommended to take immediate action to stop illegal export of paddy and other cereals from Terai boarder, maintain at least 50% food deficit as buffer stocks for non-perishables and stop cane/sugar import to restore national food self sufficiency. Establishment of high tech green houses, high tech nurseries, high tech high density large fruit orchards, large farms, hydroponic houses, and tissue culture labs are also recommended. The programs on variety/breed improvement and use, fodder and feed management, infrastructure support, agriculture and veterinary services and promotion of resource centers are needed. Establishment of new buffalo fattening farms, goat farms, piggery, poultry farms, apiary and fish farms are needed. Establishment of capacious cold storages and maintain the cold chain and linking production to outlet markets are equally important. Export promotions program on coffee, tea and poultry eggs should be strengthen immediately. For this, improved agriculture funding is necessary, which shall be from increasing public investment and attraction of the private funds together. It is needed to provide the short term farm subsidies on production inputs by the local governments and long term agriculture subsidies on overall agriculture infrastructure, research, knowledge dissemination, capacity building, market support, institutional strengthening and agriculture risk reduction with farmer's welfare scheme and insurance by the provincial and federal governments. But, the output/production/marketing based agriculture subsidy and funding should be provided for area expansion or raising the productivity only for the prioritized commodities. It shall be targeted either to meet the national food self sufficiency or for export promotion. It is also very important to link all the development programs with improved food production, collection, distribution and consumption systems.

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