

Policy Brief: food loss and waste reduction strategies to fill the protein gap

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I. Background information

Food loss and waste (FLW) reduction is an important matter which is not only relevant to food and nutrition security e.g., [1,2,3] but also climate change [4,5,6]. Reducing FLW and the associated environmental impacts can be approached from the angle of waste prevention, namely preventing FLW from happening in the first place. It can also be addressed by waste valorization, namely reusing FLW for other value-added applications, for example, feed application.

In this study, Wageningen University and Research (WUR) investigated the FLW reduction strategies both from the prevention and valorization perspectives. Firstly, we looked into the protein potentials of using the FLW to directly fill the protein gaps at the country level. If all the FLW of a country are avoided, to what extent the protein gap of that country could be closed. Then, we investigated the alternative scenario of feeding all the FLW to chickens to see if the converted chicken proteins can fill the protein gap in that country.

II. Key findings of this study

The key findings of this study are listed as follows:

- In general, there are enough proteins to ensure the WHO-recommended protein intakes to be met at the global and continental levels
- At the country level, there are only 14 countries which do have the protein gaps. The large majority are low & middle-income countries with Slovakia as an exception (Figure 1).
- The protein gaps can be closed in the 14 countries if all the FLW in those countries are avoided (prevention strategy) (Table 1).
- 5 out of the 14 countries' protein gaps can be filled following the "chicken feed" valorization strategy (Table 2).
- The prevention strategy seems to be better off than the valorization strategy in terms of protein gap fulfilment efficiency because of the protein conversion losses for feed applications. It is also due to the assumption that the animal-product wastes can not be used for feed applications. However, since not all the FLW are avoidable, feed application still has its value when human can not use the unavoidable FLW directly.

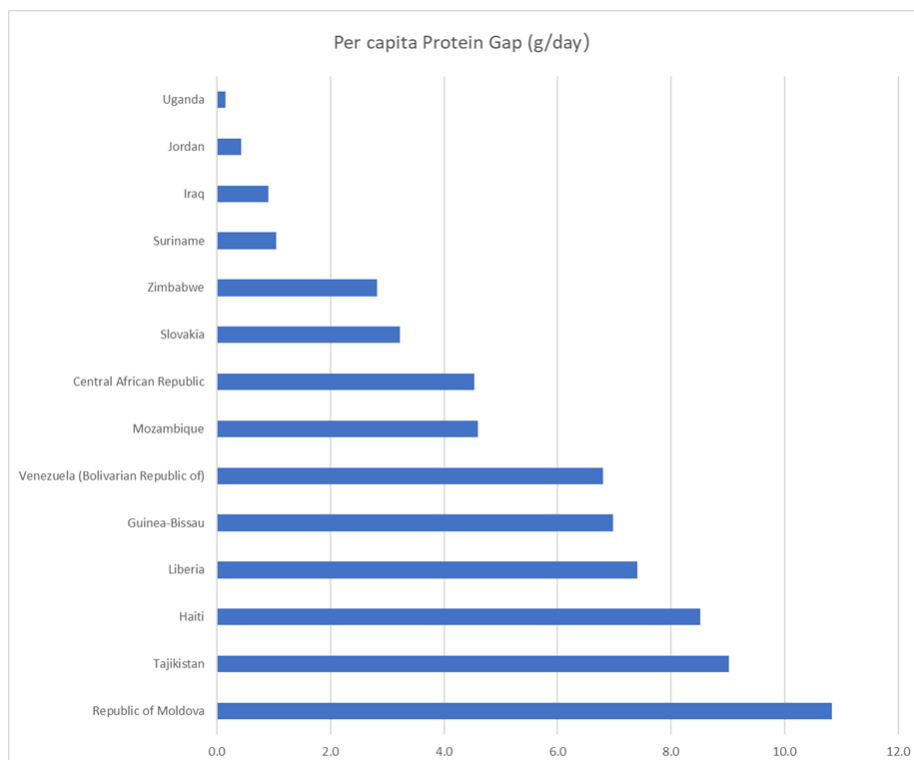


Figure 1. The 14 countries with the protein intake gaps.

Table 1 Protein gap analysis for the prevention strategy

Region	Area	Population	Protein available per person (g/day)	Protein requirements per person (g/day)	Per capita Protein Gap (g/day)	Total_protein_per_year (Ton)	Total_protein_per_year_required (Ton)	Protein Gap (Ton)	FLW_protein (Ton)	FLW_protein/Protein gap	Mitigated FLW-related GHG emissions (Ton) when protein gap is (partially) filled by FLW
Sub-Saharan Africa	Uganda	42,729,000	46.3	46.4	0.1	721,914	724,154	2,240	261,013	11654%	102,193
North Africa, West & Central Asia	Jordan	9,965,000	63.4	63.8	0.4	230,673	232,214	1,541	48,985	3179%	51,090
Latin America	Suriname	576,000	57.2	58.2	1.0	12,026	12,244	218	3,748	1718%	9,730
North Africa, West & Central Asia	Iraq	32,965,000	59.6	60.5	0.9	716,861	727,726	10,865	160,751	1480%	128,918
Europe	Slovakia	5,453,000	60.5	63.7	3.2	120,419	126,832	6,413	78,689	1227%	94,038
Sub-Saharan Africa	Zimbabwe	14,439,000	43.6	46.4	2.8	229,857	244,706	14,849	62,983	424%	650,867
Sub-Saharan Africa	Central African Republic	4,666,000	43.9	48.4	4.5	74,689	82,418	7,729	32,506	421%	462,107
Sub-Saharan Africa	Guinea-Bissau	1,874,000	42.8	49.8	7.0	29,262	34,032	4,770	16,228	340%	178,407
Sub-Saharan Africa	Mozambique	29,496,000	41.8	46.4	4.6	450,418	499,886	49,468	129,019	261%	2,104,205
Europe	Republic of Moldova	4,052,000	51.3	62.2	10.8	75,920	91,937	16,017	40,101	250%	297,292
Sub-Saharan Africa	Liberia	4,819,000	42.3	49.8	7.4	74,479	87,514	13,035	31,584	242%	362,332
Latin America	Venezuela (Bolivarian Republic of)	28,887,000	51.0	57.8	6.8	537,729	609,424	71,695	142,306	198%	3,781,441
North Africa, West & Central Asia	Tajikistan	9,101,000	49.1	58.1	9.0	163,101	193,066	29,965	54,277	181%	836,035
Latin America	Haiti	11,123,000	47.2	55.8	8.5	191,802	226,372	34,570	39,328	114%	931,736

Table 2 Protein gap analysis for the chicken feed application strategy

Region	Area	Population	Protein available per person (g/day)	Protein requirements per person (g/day)	Per capita Protein Gap (g/day)	Total_protein_per_year (Ton)	Total_protein_per_year_required (Ton)	Protein Gap (Ton)	Converted chicken protein (Ton)	Converted chicken protein/Protein Gap	Mitigated FLW-related GHG emissions (Ton) when protein gap is (partially) filled by FLW
Sub-Saharan Africa	Uganda	42,729,000	46.3	46.4	0.1	721,914	724,154	2,240	42,062	1878%	56,407
North Africa, West & Central Asia	Jordan	9,965,000	63.4	63.8	0.4	230,673	232,214	1,541	6,809	442%	31,619
North Africa, West & Central Asia	Iraq	32,965,000	59.6	60.5	0.9	716,861	727,726	10,865	27,429	252%	68,408
Latin America	Suriname	576,000	57.2	58.2	1.0	12,026	12,244	218	533	245%	9,973
Europe	Slovakia	5,453,000	60.5	63.7	3.2	120,419	126,832	6,413	14,014	219%	55,808
Sub-Saharan Africa	Zimbabwe	14,439,000	43.6	46.4	2.8	229,857	244,706	14,849	9,924	67%	951,948
Sub-Saharan Africa	Central African Republic	4,666,000	43.9	48.4	4.5	74,689	82,418	7,729	5,034	65%	704,635
Sub-Saharan Africa	Guinea-Bissau	1,874,000	42.8	49.8	7.0	29,262	34,032	4,770	3,071	64%	443,499
Sub-Saharan Africa	Liberia	4,819,000	42.3	49.8	7.4	74,479	87,514	13,035	5,926	45%	721,348
Europe	Republic of Moldova	4,052,000	51.3	62.2	10.8	75,920	91,937	16,017	6,819	43%	469,925
Sub-Saharan Africa	Mozambique	29,496,000	41.8	46.4	4.6	450,418	499,886	49,468	20,553	42%	3,180,508
North Africa, West & Central Asia	Tajikistan	9,101,000	49.1	58.1	9.0	163,101	193,066	29,965	9,598	32%	652,050
Latin America	Venezuela (Bolivarian Republic of)	28,887,000	51.0	57.8	6.8	537,729	609,424	71,695	18,986	26%	2,401,315
Latin America	Haiti	11,123,000	47.2	55.8	8.5	191,802	226,372	34,570	6,866	20%	628,437

III. Policy advice based on this study

Based on the work done by WUR the following policy advice can be given to the policy makers:

1. The policy makers should target at the 14 countries listed in Figure 1 for protein gap interventions.
2. The results that Republic of Moldova and Slovakia have the protein intake gaps are conflicting with the common notion derived from the previous study. In this study, we have used the FAO food balance sheets (2018) as the data source to derive the protein intake numbers per country. Since FAO has changed the methodology of food balance sheets calculation since 2014, there could be a gap caused by the methodological change. Anyhow, based on the new FAO food balance sheets data, Republic of Moldova and Slovakia fall in the countries with protein intake gaps which desire the policy attention. However, policy makers should use this piece of information in a more careful way and more validation on this point should be conducted.
3. When possible, FLW prevention is preferred because feed application has low protein conversion ratio and animal production is not favorable from a climate change perspective.
4. For the non-avoidable FLW, the chicken feed application strategy could be applied.
5. Moreover, it is necessary to point out that there are FLW that may not be edible even for chicken. We also acknowledge that there are other practical restrictions that affect the efficiency of FLW valorization. In this sense, the results of this research should be considered as a theoretical upper bound for the protein potentials instead of practical guideline for policy making.

6. Finally, the intake standards presented in Figure 1 and Table 1 & 2 are actually the minimum requirements suggested by WHO. To ensure the protein intakes to be met especially in the abnormal period such as period of the COV-19 outbreak, a buffer should actually be added to the minimum requirements. In this research, we have also calculated the resilient scenarios with the "buffers". In the resilient scenarios, more countries are added to the picture because they have the protein intake gaps when taking the buffers into account.

IV. Acknowledgements

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