

The cost and affordability of a healthy diet (CoAHD) indicators: methods and data sources

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BACKGROUND

One of the key reasons why millions of people are food insecure and malnourished around the world is because healthy diets are out of reach and unaffordable. Diet quality is a critical link between food security and nutrition. Poor diet quality can lead to different forms of malnutrition, including undernutrition and micronutrient deficiencies, as well as overweight and obesity. A healthy diet provides adequate calories and nutrients, but also includes a diverse intake of foods from different food groups.

Measuring and systematically monitoring the cost and affordability of healthy diets and making progress towards ensuring the affordability of healthy diets is of utmost importance and urgently needed. To this end, The Food and Agriculture Organization of the United Nations (FAO) committed to institutionalize the computation of the cost of healthy diet, and the corresponding affordability indicators, and to publish updated estimates in the annual *The State of Food Security and Nutrition in the World report*, as well as provide the full data series on FAOSTAT.

In 2020, FAO began computing, monitoring and reporting global, regional and country level indicators on the cost and affordability of a healthy diet (CoAHD), with the aim of providing global evidence on people's physical and economic access to nutritious foods to meet dietary needs for an active and healthy life, one of the core principles embedded in the definition of food security. This crucial information serves as a basis for national governments, international agencies, civil society and the private sector to work together towards improved access to healthy diets and toward achieving longstanding goals for food security, nutrition and health. Importantly, these indicators measure whether agrifood systems bring healthy diets within reach of the poorest people, considering foods that meet calorie and nutritional requirements at the lowest possible cost (Herforth et al. 2020, 2022).

Since 2020, FAO has systematically updated and reported on these indicators in the annual flagship report, *The State of Food Security and Nutrition in the World*, published by FAO, the International Fund for Agricultural Development (IFAD), the World Food Programme (WFP), the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF). From 2022, the indicators are also reported annually in five *Regional Overviews of Food Security and Nutrition* reports, for Africa, Near East and North Africa, Asia and the Pacific, Central Asia and Eastern Europe, and Latin America and the Caribbean.

The availability of these indicators at the global, regional and country levels sets the stage for increased accountability, using timely data on retail prices of diverse nutritious food items in all countries of the world. These can guide policy and programmes to help make healthy diets affordable for all people at all times, and to track progress towards this goal at the global, regional and country levels. In the coming years, FAO, in collaboration with participating countries, aims to expand the computation and reporting of these indicators to the subnational level, in order to further inform country policy and programming.

These indicators support efforts within the framework of the Sustainable Development Goals (SDGs) to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture by 2030 (SDG 2). They also support the monitoring of progress towards the objective of transforming agrifood systems to improve economic access to healthy diets and promoting "nutrition-sensitive agriculture". For definitions of these indicators, see FAOSTAT CoAHD Definitions and standards.

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DATA AND METHODOLOGY

FAO computes indicators on the cost and affordability of a healthy diet in each country, which captures people's economic access to the least-cost, locally available foods to meet requirements for a healthy diet, as defined by the food-based dietary guidelines (FBDGs). The indicators apply the global standard of a Healthy Diet Basket (HDB) to observed retail food consumer prices, along with income distributions, to provide an operational measure of people's access to locally available foods in the proportions needed to conduct an active and healthy life. The following sections describe the methodology and data sources of these component elements.

FAO computes eight cost and affordability indicators: the cost of a healthy diet; the cost of six individual food groups that make up the Healthy Diet Basket (starchy staples; animal source foods; legumes, nuts and seeds; vegetables; fruits; oils and fats); and the percentage and number of people unable to afford a healthy diet. (See Annex 1 for the full list of indicators and definitions.) The first and last indicators (cost and affordability of a healthy diet) are computed and updated each year, while the costs of the six food groups that make up the healthy diet are computed only in years when the World Bank International Comparison Program (ICP) publishes updated individual food-item price data.

The Healthy Diet Basket (HDB)

Given that the foods that make-up a healthy diet varies by local context, countries have developed national food-based dietary guidelines (FBDGs) to reflect their specific cultural context, locally available foods and dietary customs (FAO, IFAD, UNICEF, WFP and WHO, 2020). FBDGs, however, are not available for all countries or, if available, only a few are quantified, meaning they include specific food quantities. To overcome this data limitation and create a global standard of a healthy diet consistent with and reflective of the commonalities in dietary guidelines across countries, the CoAHD analysis applies the recommendations within and across food groups from the ten quantified FBDGs, which represent a range of dietary recommendations articulated by countries. These are then locally adapted to each country through the assignment of least-cost food items available by food group in each country. The ten FBDGs.

This global standard, called the Healthy Diet Basket (HDB), is based on the average food group proportions and recommendations across FBDGs. The HDB food group amounts are the median amounts of each food group recommended in the ten quantified FBDGs (shown in Table 1), rounded to the nearest whole integer in units of 10 kcal, for ease of communication (Herforth *et al.*, 2022). The resulting food group proportions are verified for consistency by comparison to national food guidelines globally (see Table A2 in Annex 2). The results show that the HDB approximates a larger range of FBDGs than only the ten that were initially quantified and captures the commonalities across national guidelines.

The composition of the final HDB, shown in Table 2, indicates the dietary energy and equivalent gram content when reference foods for each food group are used to convert calories to grams. The HDB criterion is identified to meet a dietary energy intake target of 2 330 kcal per day and consists of locally available items from six food groups: starchy staples, animal source foods, legumes nuts and seeds, fruits, vegetables and oils (Herforth *et al.*, 2022). Using this HDB, the distribution of food groups on a per-calorie basis was calculated (see Figure 1). These amounts represent an average food basket across FBDGs, for the purpose of monitoring the cost of a healthy diet.¹

¹ Although the HDB is calculated based on energy content of food items, it is shown by volume to demonstrate robustness in approximating a variety of national FBDGs. See Figure 7 in Herforth *et al.*, 2022 for the composition of the HDB by volume, when the caloric content is converted into reference foods.

Table 1. Average food group amounts recommended across the ten national food-based dietary guidelines used to estimate the Healthy Diet Basket (scaled to meet a consistent dietary energy intake target of 2 330 kcal)

Country	Starchy staples		Vegetables		Fruits		Protein-rich foods*		Oils	
	kcal	grams	kcal	grams	kcal	grams	kcal	grams	kcal	grams
Argentina	1 000	278	145	482	228	362	638	446	320	36
Benin	1 216	338	133	443	167	266	462	323	352	40
China	1 238	344	117	391	169	269	568	398	237	27
India	1 009	280	123	409	110	175	809	566	279	32
Jamaica	1 162	323	117	389	130	206	630	441	291	33
Malta	1 343	373	112	375	148	234	572	400	155	18
Netherlands	1 205	335	74	247	124	197	577	404	349	39
Oman	942	262	101	337	370	587	335	234	583	66
United States of America	1 038	288	89	297	187	297	753	527	263	30
Viet Nam	1 165	324	92	307	166	263	640	447	267	30
Mean	1 132	314	110	368	180	286	598	422	310	35
Median	1 164	323	114	382	167	264	604	419	285	32
Healthy Diet Basket (HDB)	1 160	322	110	367	160	254	600	420	300	34

Notes: Healthy Diet Basket (HDB) is the global standard based on the average food group proportions and recommendations across national food-based dietary guidelines (FBDGs).* Protein-rich foods here combine dairy with other protein-rich foods, including meat, fish, egg, legumes, and/or nuts and seeds.

Source: Herforth, A., Venkat, A., Bai, Y., Costlow, L., Holleman, C. & Masters, W.A. 2022. *Methods and options to monitor the cost and affordability of a healthy diet globally*. Background paper for *The State of Food Security and Nutrition in the World 2022*. FAO Agricultural Development Economics Working Paper 22-03. Rome, FAO. <https://doi.org/10.4060/cc1169en>

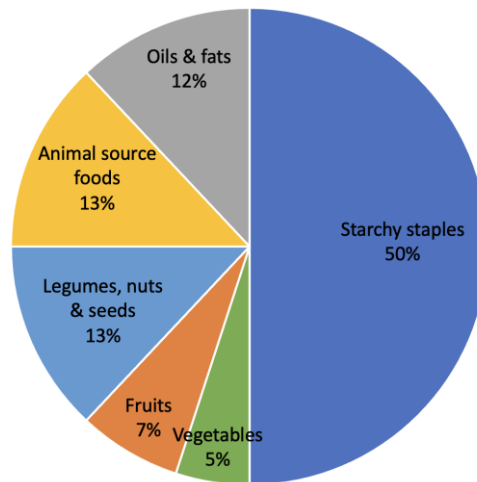
Table 2. Healthy Diet Basket content by food group, kcal and grams of reference food

Food group	Minimum number of food items selected for cost of healthy diet	Total energy content (kcal)	Equivalent gram content, by reference food (edible portion)
Starchy staples	2	1 160	322 g dry rice
Vegetables	3	110	270–400 g vegetables
Fruits	2	160	230–300 g fruits
Animal source foods	2	300	210 g egg
Legumes, nuts and seeds	1	300	85 g dry bean
Oils and fats	1	300	34 g oil

Note: To equate calories and grams for starchy staples, dry rice is the reference food; for animal source foods, egg; for legumes, nuts and seeds, dry bean is the reference food. For fruits and vegetables, the range is based on the lowest to highest kcal/g across the dataset for each.

Source: Herforth, A., Venkat, A., Bai, Y., Costlow, L., Holleman, C. & Masters, W.A. 2022. *Methods and options to monitor the cost and affordability of a healthy diet globally*. Background paper for *The State of Food Security and Nutrition in the World 2022*. FAO Agricultural Development Economics Working Paper 22-03. Rome, FAO. <https://doi.org/10.4060/cc1169en>

Figure 1. Composition of the Healthy Diet Basket (percent of dietary energy)



Source: Herforth, A., Venkat, A., Bai, Y., Costlow, L., Holleman, C. & Masters, W.A. 2022. *Methods and options to monitor the cost and affordability of a healthy diet globally*. Background paper for *The State of Food Security and Nutrition in the World 2022*. FAO Agricultural Development Economics Working Paper 22-03. Rome, FAO. <https://doi.org/10.4060/cc1169en>

The cost of a healthy diet

A healthy diet provides not only adequate calories but also adequate levels of all essential nutrients and food groups needed for an active and healthy life. The cost of a healthy diet is defined as the cost of the least expensive, locally available foods that meet the FBDGs requirements, with an energy intake of 2 330 kcal/day. The FBDGs analysed recommend food quantities for each food group and provide a wide regional representation. Although it is not selected based on nutrient content but is determined by FBDGs, this diet meets, on average, nearly 95 percent of nutrient needs, and, thus, is considered nutrient-adequate.

The prices of items in each food group needed for a healthy diet were obtained using price data from the International Comparison Program (ICP) managed by the World Bank as national averages for an entire year, most recently 2017 (World Bank, 2023a). Item definitions are internationally standardized, allowing classification by food group and calculation of the least-costs to reach FBDG requirements in each country, representing an average across markets and throughout the year.

The cost of a healthy diet is estimated for 169 countries in year 2017 (reference year) using ICP prices to identify the lowest-cost items available in each country to meet HDB quantities of each food group. Each item is classified into its food group, as specified in Table 2, and its retail cost per day is calculated as the cost per quantity containing the energy content required for the item's food group, divided by the number of items per group. For each country, a total of 11 least-cost food items are selected in the basket: two for starchy staples, three for vegetables, two for fruits, two for animal source foods, one for legumes, nuts and seeds, and one for oils and fats. To allow substitution within energy balance, the cost per day of the least expensive locally available items in each food group is determined by the price per kcal (p_i) for each item (i) as purchased in markets, as observed in each country, multiplied by the calorie target (q_i) for that food group from Table 2, as follows:

$$Cost_{StarchyStaples} = \min\{\sum_{i=1}^2 p_i q_i\}, \text{ where each } q_i=580 \text{ kcal } (=160/2) \text{ and item } i \text{ is a starchy staple} \quad (1)$$

$$Cost_{AnimalFoods} = \min\{\sum_{i=1}^2 p_i q_i\}, \text{ where each } q_i=150 \text{ kcal } (=300/2), \text{ and item } i \text{ is an animal source food} \quad (2)$$

$$Cost_{LegsNutsSeeds} = \min\{p_i q_i\}, \text{ where each } q_i=300 \text{ kcal}, \text{ and item } i \text{ is a legume, nut or seed} \quad (3)$$

$$Cost_{Vegetables} = \min\{\sum_{i=1}^3 p_i q_i\}, \text{ where each } q_i=66.7 \text{ kcal } (=110/3), \text{ and item } i \text{ is a vegetable} \quad (4)$$

$$Cost_{Fruits} = \min\{\sum_{i=1}^2 p_i q_i\}, \text{ where each } q_i=80 \text{ kcal } (=160/2), \text{ and item } i \text{ is a fruit} \quad (5)$$

$$Cost_{Oils} = \min\{p_i q_i\}, \text{ where each } q_i=300 \text{ kcal}, \text{ and item } i \text{ is a lipid (oil or fat)} \quad (6)$$

The six food group cost indicators in equations (1) to (6) are summed to obtain the overall cost of a healthy diet per day, as follows:

$$Cost_{HealthyDiet} = \sum_{j=1}^6 Cost_j, \text{ for all } j = \{1, \dots, 6\} \text{ food groups} \quad (7)$$

The ICP database provides retail food price data for year 2017, expressed in local currency units (LCU), for a wide range of internationally standardized items (680 foods and non-alcoholic beverages). These prices were reported by each country's official national statistics office (NSO) in coordination with the global office of the ICP. For international comparisons, prices in LCU are converted into international dollars using purchasing power parity (PPP) exchange rates for private consumption computed by the ICP and reported in the World Development Indicators (WDI) database (World Bank, 2023b). For countries with missing PPP data in any year, PPP imputations are applied using an autoregressive integrated moving average model with external explanatory variable (ARIMAX).

The ICP is currently the only source of retail food price data for internationally standardized items, which it collects as part of the program's larger effort to compute purchasing power parity (PPP) exchange rates across all countries. However, these data are only available once every five years, which does not allow for yearly global monitoring of diet costs to guide programmes and policies. In the absence of up-to-date food price data, a methodology was developed and validated for updating the diet cost indicator in the gap years between the ICP publication cycles (Bai *et al.*, forthcoming). The methodology uses the more frequently updated national consumer food price index (CPI) data (published by FAO) to inflate the 2017 cost of a healthy diet to estimate the cost in years after the most recent ICP data from 2017.

The national CPI dataset tracks changes in monthly general and food CPIs at the national level with reference to a base year of 2015. Annual CPIs are computed as simple averages of the 12 monthly CPIs within a year. The cost of a healthy diet is estimated by multiplying each country's 2017 actual cost, expressed in local currency units (LCU), with the CPI ratio:

$$Cost_{HealthyDiet,t} = \frac{Cost_{HealthyDiet,2017} * \left(\frac{FoodCPI_t}{FoodCPI_{2017}} \right)}{PPP_t} \quad (8)$$

Where $t = 2018, 2019, 2020$ represents each year when the cost of a healthy diet is updated using each country's food CPI relative to the base year 2017.² The cost of a healthy diet is first updated in LCU and then converted into international dollars using the WDI PPP for private consumption in each year, to compare the cost across countries and political entities.

In the case of the 2018-2020 healthy diet costs, a limitation of this method is that changes in the cost depend on aggregate food CPIs and do not reflect item-specific changes in food prices, nor any differential changes in the price of different food groups, due to the lack of item-level food price data over time. Currently, 170 governments report overall food CPIs while 58 countries also report more disaggregated indexes grouped by different types of foods, and only 49 countries report price level information for at least some individual food items (Bai *et al.*, 2021). Therefore, while the overall cost of a healthy diet can be updated for years 2018–2020, the cost of the six food groups of a healthy diet shown in equations (1) to (6) cannot be updated due to lack of disaggregated food CPI data. As part of a medium-term strategy, FAO, the World Bank and Tufts University envision a partnership to expand the capture of country-level nutritious food-item price data in the gap years between the ICP publication cycles, to support updating the cost of a healthy diet indicator.

² To update the cost of a healthy diet in 2018–2020, food CPI are used for all countries except Bermuda, Central African Republic and Guyana, for which the general CPI is used.

The affordability of a healthy diet

To determine whether a diet is affordable or not, the cost of a healthy diet is compared with a standard of income. The affordability of a healthy diet indicator compares the cost of a healthy diet with the estimated income distribution in a given country, using income distributions available in the Poverty and Inequality Platform (PIP) of the World Bank (2023c). A diet is considered unaffordable when its cost exceeds 52 percent of the average income in a given country. This percentage accounts for the portion of income that can be credibly reserved for food, based on observation that 52 percent is the average share of food expenditure in low-income countries. It is assumed that a minimum of 48 percent of expenditures must be reserved for non-food expenditures, such as housing, transport, education, health and farm inputs. In reality, 48 percent for non-food expenditures is a conservative assumption. For instance, in middle- and high-income countries, non-food expenditures may require a higher share of expenditures.

The percentage of people for whom the cost of the diet is unaffordable is calculated based on this threshold and comparing the cost of the diet with country income distributions. These proportions are then multiplied by the 2020 population in each country, using the World Bank's World Development Indicators (WDI) to obtain the number of people who cannot afford a healthy diet in a given country. Thus, two affordability indicators are estimated: the percentage and the number of people in a country who are unable to afford a healthy diet.

CONCLUSION

FAO systematically monitors and reports on food cost and affordability of a healthy diet indicators annually. In addition, periodic revisions to the entire data series are carried out to refine and improve the accuracy of the indicators as new data become available and as methodologies advance (a common practice for other FAO food security indicators). This process usually implies backward revisions of the entire series; therefore, readers are advised to refrain from comparing series across different editions of *The State of Food Security and Nutrition in the World* report and should always refer to the latest edition of the report and the data published on FAOSTAT, including for values in past years.

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Annex 1. Cost and affordability of a healthy diet reported on FAOSTAT

Table A1. Cost and affordability of a healthy diet indicators computed and reported on FAOSTAT

Item	Description	Year
Cost of a healthy diet (PPP dollar per person per day)	The cost of a healthy diet indicator is the cost of purchasing the least expensive locally available foods to meet requirements for energy and food-based dietary guidelines (FBDGs), for a representative person within energy balance at 2 330 kcal/day. The cost of a healthy diet is converted to international dollars using purchasing power parity (PPP).	2017 and updated annually
Cost of starchy staples (PPP dollar per person per day)	The cost of purchasing the least expensive locally available starchy staples to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Starchy staples are one of the six food groups within the Healthy Diet Basket (HDB). The cost of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017.	2017
Cost of animal source foods (PPP dollar per person per day)	The cost of purchasing the least expensive locally available animal source foods to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Animal source foods are one of the six food groups within the Healthy Diet Basket (HDB). The cost of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017.	2017
Cost of legumes, nuts and seeds (PPP dollar per person per day)	The cost of purchasing the least expensive locally available legumes, nuts and seeds to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Legumes, nuts and seeds are one of the six food groups within the Healthy Diet Basket (HDB). The cost of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017.	2017
Cost of vegetables (PPP dollar per person per day)	The cost of purchasing the least expensive locally available vegetables to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Vegetables are one of the six food groups within the Healthy Diet Basket (HDB). The cost of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017.	2017
Cost of fruits (PPP dollar per person per day)	The cost of purchasing the least-expensive locally available fruits to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Fruits are one of the six food groups within the Healthy Diet Basket (HDB). The cost of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017	2017
Cost of oils and fats (PPP dollar per person per day)	The cost of purchasing the least expensive locally available oils or fats to meet daily intake levels recommended in food-based dietary guidelines (FBDGs). Oils and fats are one of the six food groups within the Healthy Diet Basket (HDB). The cost	2017

Item	Description	Year
	of the food group is converted to international dollars using purchasing power parity (PPP). Data available in year 2017.	
Percentage of the population unable to afford a healthy diet (percent)	The indicator expresses the percentage of the total population unable to afford a healthy diet. A healthy diet is considered unaffordable in a country when its cost exceeds 52 percent of household income. This percentage accounts for the portion of income that can be credibly reserved for food, based on observations that the population in low-income countries spend, on average, 52 percent of their income on food, as derived from the 2017 national accounts household expenditure data of the World Bank's International Comparison Programme (ICP). Income data are provided by the World Bank's Poverty and Inequality Platform.	2017 and updated annually
Number of people who cannot afford a healthy diet (million)	The indicator expresses the total number of people unable to afford a healthy diet. The indicator is computed by multiplying the percentage of the population in a country unable to afford a healthy diet by population data taken from the World Development Indicators (WDI) of the World Bank, to obtain the number of people who cannot afford a healthy diet in a given country and year.	2017 and updated annually

Source: FAO. 2023. Cost and affordability of a healthy diet – Definition and standards. In: *FAOSTAT*. Rome.
<https://www.fao.org/faostat/en/#data/CAHD>

Annex 2. Food group proportions depicted in food-based dietary guidelines

Table A2. Food group proportions (by volume) depicted in plate-shaped food-based dietary guidelines from all countries where they are available

Country (year)	Starchy staples (%)	Vegetables (%)	Fruits (%)	Vegetables and fruits (%)	Protein-rich foods* (%)	Oils and fats (%)	Total (%)
Antigua and Barbuda (2013)	39	14	14	28	28	5	100
Argentina (2015)	25	n.a.		50	20	5	100
Australia (2013)	30	28	16	44	26	0	100
Canada (2019)	25	n.a.		50	25	0	100
Chile (2013)	15	30	20	50	30	5	100
Colombia (2015)	30	n.a.		27	38	5	100
Dominica (2007)	28	25	17	42	25	5	100
Ecuador (2018)	25	n.a.		50	20	5	100
Germany (2017)	30	25	17	42	25	3	100
Grenada (2006)	47	10	10	20	27	6	100
Guyana (2018)	33	15	15	30	30	7	100
India (2018)	27	n.a.		50	20	3	100
Italy (2018)	20	27	27	54	20	6	100
Jamaica (2015)	30	24	25	49	18	3	100
Latvia (2008)	25	n.a.		50	25	0	100
Malawi (unofficial)	33	23	22	45	17	5	100
Malta (2015)	25	27	20	47	25	3	100
Mexico (2015)	33	16	16	32	35	0	100
Oman (2009)	34	15	15	30	36	0	100
Pakistan (2018)	33	19	15	34	27	6	100
Panama (2013)	38	16	16	32	25	5	100
Peru (2019)	36	16	16	32	27	5	100
Poland (2020)	25	n.a.		50	25	0	100
Portugal (2003)	27	24	20	44	26	3	100
Qatar (2015)	27	25	13	38	35	0	100
Republic of Korea (2015)	30	24	16	40	30	0	100
Switzerland (2011)	40	n.a.		40	20	0	100
United Kingdom of Great Britain and Northern Ireland (2016)	37	n.a.		37	24	2	100
United States of America (2020)	25	30	20	50	25	0	100
Uruguay (2016)	28	30	20	50	16	6	100
Zambia (2021)	34	15	18	33	33	0	100
Mean	30.1	21.7	17.6	41.0	25.9	3.0	100
Median	30.0	24.0	16.5	42.0	25.0	3.0	100
Mode	25.0	24.0	20.0	50.0	25.0	0.0	100
HDB	25.3%	28.8%	19.9%	48.8%	23.3%	2.7%	100%

Notes: * Protein-rich foods include dairy, other animal source foods, legumes, and sometimes nuts and seeds. n.a. values are absent for fruits and vegetables as separate groups in countries where the food guide represents them in a single combined group.

Source: Herforth, A., Venkat, A., Bai, Y., Costlow, L., Holleman, C. & Masters, W.A. 2022. *Methods and options to monitor the cost and affordability of a healthy diet globally*. Background paper for *The State of Food Security and Nutrition in the World 2022*. FAO Agricultural Development Economics Working Paper 22-03. Rome, FAO. <https://doi.org/10.4060/cc1169en>