**SUPPLEMENTARY MATERIAL**

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# Table S1. Publications reviewed and the metrics reported

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref #** | **Reference** | **Country** | **Household consumption & expenditure data source** | **Supply/****per capita /day** | **Supply/ AME/day** | **Nutrient density** | **Estimated inadequacy** |
| (1) | Ambagna & Dury (2016) | Cameroon | Deuxième/Troisième Enquête Camerounaise auprès des Ménages |  | X |  | X |
| (2) | Beegle et al. (2010) | Tanzania | Survey modelled after Household Budget Survey (2006/07) | X |  |  |  |
| (3) | Bell et al. (2019) | Bangladesh | Bangladesh Integrated Household Survey (2011/12) |  |  |  |  |
| (4) | Bermudez et al. (2012) | Bangladesh | ﻿Bangladesh Household Income and Expenditure Survey (2005) |  | X |  | X |
| (5) | Bogard & Mamun (2016) | Bangladesh | Bangladesh Integrated Household Survey (2011/12) |  |  |  |  |
| (6) | Bogard et al. (2017) | Bangladesh | Household Income and Expenditure Survey (1991, 2000, 2010) |  | X |  |  |
| (7) | Bromage et al. (2018) | Mongolia | Mongolian Household Socio-Economic Survey (2012, 2014) | X | X | X |  |
| (8) | Chakrabarti et al. (2018) | India | ﻿61st/68th round of the ﻿National Sample Survey (2004/05, 2011/12) |  |  |  |  |
| (9) | Chege et al. (2015) | Kenya | Survey modelled after standard HCES food consumption module |  | X |  | X |
| (10) | D’Souza & Tandon (2019) | Bangladesh | Bangladesh Integrated Household Survey (2011/12) |  | X |  | X |
| (11) | Dary & Jariseta (2012) | Uganda | National Household Survey (2005/06) |  | X |  |  |
| (12) | de Weerdt et al. (2014) | Tanzania | Survey modelled after Household Budget Survey (2006/07) | X |  |  | X |
| (13) | DeFries et al. (2018) | India | 7 rounds of the National Sample Survey | X |  |  | X |
| (14) | Donovan & Massingue (2007) | Mozambique | Trabalho de Inquérito Agricola (2002, 2005) |  | X |  |  |
| (15) | Dop et al. (2012) | Cape Verde | I﻿nquérito às Despesas e Receitas Famílias (2001/02) |  | X | X |  |
| (16) | Ecker & Qaim (2011) | Malawi | Second Integrated Household Survey (2004/05) | X |  |  | X |
| (17) | Ecker & Qaim (2008) | Malawi | Second Integrated Household Survey (2004/05) | X |  |  | X |
| (18) | Engle-Stone & Brown (2015) | Cameroon | Troisième Enquête Camerounaise auprès des Ménages |  | X |  |  |
| (19) | Engle-Stone et al. (2017) | Bangladesh | ﻿Bangladesh Household Income and Expenditure Survey (2010) |  | X |  | X |
| (20) | Euler et al. (2017) | Indonesia | Survey modelled after Household Socio-Economic Survey |  | X |  | X |
| (21) | Fiedler (2014) | Bangladesh | ﻿Bangladesh Household Income and Expenditure Survey (2010) |  | X | X | X |
| (22) | Fiedler et al. (2012) | India | ﻿61st round of the ﻿National Sample Survey (2004/05) |  | X |  | X |
| (23) | Fiedler & Lividini (2014) | Zambia | Living Conditions Monitoring Survey V (2006) |  | X |  | X |
| (24) | Fiedler et al. (2015) | Bangladesh | ﻿Bangladesh Household Income and Expenditure Survey (2010) |  | X |  | X |
| (25) | Fiedler et al. (2016) | Bangladesh | Bangladesh Household Income and Expenditure Survey (2005) |  | X |  | X |
| (26) | Fiedler et al. (2015) | Bangladesh | Bangladesh Household Income and Expenditure Survey (2005) |  | X |  | X |
| (26) | Fiedler et al. (2013) | Zambia | Living Conditions Monitoring Survey V (2006) |  | X |  | X |
| (27) | Fiedler et al. (2013) | Zambia | Living Conditions Monitoring Survey V (2006) |  | X |  | X |
| (28) | Gilbert et al. (2019) | Malawi | Third/Fourth Integrated Household Survey (2010/11, 2016/17) | X |  |  | X |
| (29) | Hall et al. (2019) | Malawi | Third Integrated Household Survey (2010/11) |  | X |  | X |
| (30) | Hirvonen et al. (2016) | Ethiopia | ﻿Household Consumption Expenditure Survey (2010/11) | X |  |  |  |
| (31) | Hjelm et al. (2016) | Madagascar, Malawi, Nepal, Tanzania, Uganda | Enquête Nationale Sur le Suivi des Objectifs du Millénaire pour le Développement à Madagascar (ENSOMD) ;Third Integrated Household Survey (2010/11);Nepal Living Standard Survey (2010/11);Tanzania National Panel Survey (2010/2011);Uganda National Panel Survey (2009/2010) | X | X |  | X |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref #** | **Reference** | **Country** | **Household consumption & expenditure data source** | **Supply/ per capita/ day** | **Supply/ AME/day** | **Nutrient density** | **Estimated** **inadequacy** |
| (32) | Imhoff-Kunsch et al. (2019) | Solomon Islands | ﻿Household Income and Expenditure Survey (2012/13) |  | X |  | X |
| (33) | Jarista et al. (2012) | Uganda | National Household Survey (2005/06) |  | X | X | X |
| (34) | Jati et al. (2012) | Indonesia | ﻿Household Socio-Economic Survey (BPS 2008) |  |  | X | X |
| (35) | Johnecheck & Holland (2007) | Afghanistan | National Risk and Vulnerability Assessment (2003) | X |  |  | X |
| (36) | Joy et al. (2015) | Malawi | Third Integrated Household Survey (2010/11) |  | X |  | X |
| (37) | Kankwamba & Kornher (2019) | Malawi | Third/Fourth Integrated Household Survey (2010/11, 2016/17) | X |  |  |  |
| (38) | Karageorgou et al. (2018) | Bangladesh | Bangladesh Integrated Household Survey (2011/12) | X | X |  |  |
| (39) | Lividini & Fiedler (2015) | Zambia | Living Conditions Monitoring Survey V (2006) |  | X |  | X |
| (40) | Lividini et al. (2013) | Bangladesh | Bangladesh Household Income and Expenditure Survey (2005) |  | X |  | X |
| (41) | Marivoet et al. (2018) | Dem. Rep. of the Congo | ﻿﻿Enquête 123: données transversales sur la consommation des ménages collectées |  | X |  | X |
| (42) | Mathiassen & Hollema (2014) | Nepal, Uganda | ﻿Uganda National Panel Survey (2009/10);﻿Nepal Living Standard Survey (2010/11) |  |  |  | X |
| (43) | Mishra & Ray (2009) | Vietnam | Vietnamese Household Living Standard Surveys (1993, 1998, 2004) | X |  |  | X |
| (44) | Molini (2006) | Vietnam | Vietnamese Household Living Standard Survey (1993, 1998) | X |  |  |  |
| (45) | Mwangi et al. (2016) | Bangladesh | Bangladesh Integrated Household Survey (2011/12) |  | X |  | X |
| (46) | Nguyen & Winters (2011) | Vietnam | ﻿Vietnam Household Living Standards Surveys | X |  |  |  |
| (47) | Rahman (2012) | Bangladesh | Bangladesh Household Income and Expenditure Survey (2005) | X |  |  |  |
| (48) | Rose & Charlton (2002) | South Africa | ﻿Income and Expenditure Survey (1995) |  | X |  | X |
| (49) | Skoufias (2002) | Indonesia | National Socio-Economic Surveys (1996, 1999) | X |  |  |  |
| (50) | Smith et al. (2006) | Burundi, Ethiopia, Ghana, Guinea, Kenya, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda, Zambia | Étude nationale sur les conditions de vie des populations (1998)Household Income, Consumption & Expenditure Survey (1999/2000)Ghana Living Standards Survey 4Enquête intégrale sur les conditions de vie des ménages guinéenKenya Welfare Monitoring Survey IIIMalawi Integrated Household Survey (19997/98)Mozambique Inqerito nacional aos agregados familiareas sobre as condicoes de vidaEnquête intégrale sur les conditions de vie des ménages rwandaiseEnquête Sénégalaise auprès des ménages IITanzanian Household Budget SurveyUgandan National Household Survey (1999/2000)Zambia Living Conditions Monitoring Survey I (1996) | X |  |  | X |
| (51) | Smith et al. (2019) | India | 7 rounds of the National Sample Survey | X |  |  | X |
| (52) | Tandon & Landes (2010) | India | ﻿61st round of the ﻿National Sample Survey (2004/05) | X |  |  |  |
| (53) | Trinh Thi et al. (2018) | Vietnam | Vietnam Household Living Standards Survey | X |  |  |  |
| (54) | Troubat & Grünberger (2017) | Mongolia | Mongolian Household Socio-Economic Survey (2007/08) | X |  |  |  |
| (55) | Ulimwengu et al. (2011) | Uganda | National Household Survey (2005/06) | X |  |  | X |
| (56) | Verduzco-Gallo et al. (2014) | Malawi | Second/Third Integrated Household Survey (2010/11, 2016/17) | X |  |  | X |
| (57) | Weinberger (2004) | India | ﻿50th round of the ﻿National Sample Survey (1993/94) |  | X |  | X |
| (58) | Worku et al. (2017) | Ethiopia | ﻿Household Consumption Expenditure Surveys |  | X |  |  |

# Table S2. Characteristics of Household Consumption & Expenditure Survey (HCES) food consumption data used in the included publications

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref #** | **Reference** | **Country** | **HCES: Type of dietary data**  | **HCES: Time horizon** | **Compared HCES to individual intake data?** | **Individual intake: type of data** | **Individual intake: comparability to HCES** | **Individual intake: demographics of individuals** |
| (1) | Ambagna & Dury (2016) | Cameroon | Consumption recall | 10 days (rural) & 15 days (urban) |  |  |  |  |
| (2) | Beegle et al. (2010) | Tanzania | Consumption recall | 7 days, 14 days, & 12 months |  |  |  |  |
| (3) | Bell et al. (2019) | Bangladesh | Consumption recall | 7 days |  |  |  |  |
| (4) | Bermudez et al. (2012) | Bangladesh | Acquisition recall | 14 days |  |  |  |  |
| (5) | Bogard & Mamun (2016) | Bangladesh | Consumption recall | 7 days |  |  |  |  |
| (6) | Bogard et al. (2017) | Bangladesh | Consumption recall | 7 days |  |  |  |  |
| (7) | Bromage et al. (2018) | Mongolia | Consumption recall | 7 days (rural) & 10 to 30 days (urban) | X | Multipass 24-hour individual recall | Individuals of households from HCES sample | All household members |
| (8) | Chakrabarti et al. (2018) | India | Consumption recall | 1 month |  |  |  |  |
| (9) | Chege et al. (2015) | Kenya | Consumption recall | 7 days |  |  |  |  |
| (10) | D’Souza & Tandon (2019) | Bangladesh | Consumption recall | 7 days |  |  |  |  |
| (11) | Dary & Jariseta (2012) | Uganda | Consumption recall | 7 days | X | Multipass 24-hour individual recall | Different sample1 | Children <5 years old & women |
| (12) | de Weerdt et al. (2014) | Tanzania | Consumption recall | 7 days, 14 days, & 12 months |  |  |  |  |
| (13) | DeFries et al. (2018) | India | Consumption & expenditure recall | 1 month |  |  |  |  |
| (14) | Donovan & Massingue (2007) | Mozambique | Acquisition recall | 1 year |  |  |  |  |
| (15) | Dop et al. (2012) | Cape Verde | Direct weighed observation | 7 days |  |  |  |  |
| (16) | Ecker & Qaim (2011) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (17) | Ecker & Qaim (2008) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (18) | Engle-Stone & Brown (2015) | Cameroon | Acquisition recall | 3 & 7 days | X | Single-pass 24-hour individual recall2 | Different sample1 | Children <5 years old & women |
| (19) | Engle-Stone et al. (2017) | Bangladesh | Consumption recall | 2 days |  |  |  |  |
| (20) | Euler et al. (2017) | Indonesia | Consumption recall | 7 days |  |  |  |  |
| (21) | Fiedler (2014) | Bangladesh | Consumption recall | 2 days |  |  |  |  |
| (22) | Fiedler et al. (2012) | India | Consumption recall | 1 month |  |  |  |  |
| (23) | Fiedler & Lividini (2014) | Zambia | Acquisition recall | 14 days |  |  |  |  |
| (24) | Fiedler et al. (2015) | Bangladesh | Acquisition recall | 14 days |  |  |  |  |
| (25) | Fiedler et al. (2016) | Bangladesh | Consumption recall | 2 days |  |  |  |  |
| (26) | Fiedler et al. (2015) | Bangladesh | Consumption recall | 2 days |  |  |  |  |
| (26) | Fiedler et al. (2013) | Zambia | Acquisition recall | 14 days |  |  |  |  |
| (27) | Fiedler et al. (2013) | Zambia | Acquisition recall | 14 days |  |  |  |  |
| (28) | Gilbert et al. (2019) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (29) | Hall et al. (2019) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (30) | Hirvonen et al. (2016) | Ethiopia | Consumption recall | 3 & 4 days |  |  |  |  |
| (31) | Hjelm et al. (2016) | Madagascar, Malawi, Nepal, Tanzania, Uganda | Acquisition recall | Varies |  |  |  |  |

1 Individual dietary data surveyed from a different sample of household compared to HCES sample

2 10% of individuals in the total sample were randomly selected for multipass dietary recall methods

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref #** | **Reference** | **Country** | **HCES: Type of dietary data** | **HCES: Time horizon** | **Compared to individual intake data?** | **Individual intake: type of data** | **Individual intake: comparability to HCES** | **Individual intake: demographics of individuals** |
| (32) | Imhoff-Kunsch et al. (2019) | Solomon Islands | Expenditure diary | 14 days |  |  |  |  |
| (33) | Jarista et al. (2012) | Uganda | Consumption recall | 7 days |  |  |  |  |
| (34) | Jati et al. (2012) | Indonesia | Expenditure recall | 7 days |  |  |  |  |
| (35) | Johnecheck & Holland (2007) | Afghanistan | Consumption recall | 7 days |  |  |  |  |
| (36) | Joy et al. (2015) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (37) | Kankwamba & Kornher (2019) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (38) | Karageorgou et al. (2018) | Bangladesh | Consumption recall | 7 days | X | Single-pass 24-hour individual recall | Individuals of households from HCES sample | All household members |
| (39) | Lividini & Fiedler (2015) | Zambia | Acquisition recall | 14 days |  |  |  |  |
| (40) | Lividini et al. (2013) | Bangladesh | Consumption recall | 14 days | X | 2-day observed-weighed food records | Individuals of households from HCES sample | Children <5 years old & women |
| (41) | Marivoet et al. (2018) | Dem. Rep. of the Congo | Acquisition & expenditure recall | 15 days & 6 to 12 months |  |  |  |  |
| (42) | Mathiassen & Hollema (2014) | Nepal, Uganda | Acquisition recall | 7 days |  |  |  |  |
| (43) | Mishra & Ray (2009) | Vietnam | Expenditure recall | 1 year |  |  |  |  |
| (44) | Molini (2006) | Vietnam | Expenditure recall | 1 year |  |  |  |  |
| (45) | Mwangi et al. (2016) | Bangladesh | Consumption recall | 7 days |  |  |  |  |
| (46) | Nguyen & Winters (2011) | Vietnam | Expenditure recall | 1 year |  |  |  |  |
| (47) | Rahman (2012) | Bangladesh | Consumption recall | 14 days |  |  |  |  |
| (48) | Rose & Charlton (2002) | South Africa | Expenditure recall | 1 month |  |  |  |  |
| (49) | Skoufias (2002) | Indonesia | Consumption recall | 7 days |  |  |  |  |
| (50) | Smith et al. (2006) | Burundi, Ethiopia, Ghana, Guinea, Kenya, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda, Zambia | Acquisition & expenditure recall | Varies |  |  |  |  |
| (51) | Smith et al. (2019) | India | Expenditure & consumption recall | 1 month |  |  |  |  |
| (52) | Tandon & Landes (2010) | India | Expenditure recall | 1 month |  |  |  |  |
| (53) | Trinh Thi et al. (2018) | Vietnam | Expenditure recall | 1 year |  |  |  |  |
| (54) | Troubat & Grünberger (2017) | Mongolia | Consumption recall | 10 days |  |  |  |  |
| (55) | Ulimwengu et al. (2011) | Uganda | Consumption recall | 7 days |  |  |  |  |
| (56) | Verduzco-Gallo et al. (2014) | Malawi | Consumption recall | 7 days |  |  |  |  |
| (57) | Weinberger (2004) | India | Expenditure recall | 30 days |  |  |  |  |
| (58) | Worku et al. (2017) | Ethiopia | Consumption recall | 7 days |  |  |  |  |

# **Table S3.** Publications comparing apparent nutrient or energy intake estimates using HCES adult male equivalent methods to intake estimates calculated using individual-level dietary intake data for total populations (expanded to include all reported nutrients)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference;** **country;** **summary metric** | **Individual consumption data (N)** | **HCES dietary data, (n)** | **Study sample population (n)** | **Nutrient** | **Individual estimate** | **HCES AME estimate** | **Percentage point****difference** |
| ***I. Study compared intake estimates derived from individual-level versus HCES dietary data*** |
| Bromage *et al.* (2018) (7); Mongolia;means | 24H individual recall(N=4070) | 7-30 day recall of household meals (n=1012) | Total population(n=4070) | Energy, kcal | 1863 | 2951 | 58 |
| Carbohydrates, g | 241 | 364 | 51 |
| Protein, g | 70 | 120 | 71 |
| Total fat, g | 66 | 113 | 71 |
| Thiamin, mg | 0.8 | 1.3 | 72 |
| Riboflavin, mg | 1.2 | 2.2 | 83 |
| Niacin, mg | 13 | 23 | 72 |
| Pantothenic acid, mg | 3.1 | 5.5 | 77 |
| Vitamin B6, mg | 0.6 | 1.1 | 88 |
| Folate, μg | 132 | 208 | 58 |
| Vitamin B12, μg | 6.4 | 8.4 | 31 |
| Vitamin C, mg | 12 | 33 | 167 |
| Vitamin A, μg | 448 | 621 | 39 |
| Vitamin D, IU | 26 | 48 | 85 |
| Vitamin E, mg | 5.3 | 9.6 | 82 |
| Calcium, mg | 432 | 898 | 108 |
| Copper, mg | 1.0 | 1.5 | 48 |
| Iron, mg | 10 | 16 | 60 |
| Magnesium, mg | 168 | 283 | 68 |
| Manganese, mg | 2.2 | 3.4 | 55 |
| Phosphorous, mg | 907 | 1567 | 73 |
| Potassium, mg | 1436 | 2645 | 84 |
| Zinc, mg | 11 | 19 | 72 |
| D’Souza & Tandon (2015) (10);Bangladesh;means | 24H recall of household meals and proportions consumed by individuals(N=21,795) | 7-day recall of household meals(n=5319) | Total population(n=21,795) | Energy, kcal | 2436 | 2718 | 12 |
| Karageorgou *et al.* (2018) (38);Bangladesh;means | 24H recall of household meals and proportions consumed by individuals(N=22,173) | 7-day recall of household meals(n=5503) | Total population(n=22,173) | Energy, kcal | 2065 | 2322 | 12 |
| Protein, g | 50 | 57 | 13 |
| Carbohydrates, g | 398 | 444 | 12 |
| Total fat, g | 26 | 30 | 17 |
| Vitamin A RAE, μg | 214 | 323 | 50 |
| Vitamin D, μg | 1.1 | 1.3 | 18 |
| Vitamin E, mg | 4.5 | 5.4 | 20 |
| Thiamine, mg | 0.8 | 0.9 | 25 |
| Riboflavin, mg | 0.5 | 0.6 | 20 |
| Niacin, mg | 14 | 16 | 13 |
| Vitamin B6 | 1.2 | 1.4 | 17 |
| Folate, μg | 121 | 157 | 31 |
| Vitamin C, mg | 42 | 65 | 55 |
| Calcium, mg | 274 | 343 | 25 |
| Iron, mg | 9.9 | 12 | 21 |
| Sodium, mg | 4225 | 5855 | 39 |
| Potassium, mg | 1395 | 1745 | 25 |
| Magnesium, mg | 321 | 377 | 18 |
| Zinc, mg | 8.6 | 9.8 | 14 |

# **Table S4.** Publications comparing apparent nutrient, energy or fortifiable food item intake estimates using HCES adult male equivalent methods to intake estimates calculated using individual-level dietary intake data for infants and children where no studies adjusted for assumed or recommended breastmilk intake (expanded to include all reported nutrients and food items)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference;** **country;** **summary metric** | **Individual dietary assessment data (N)** | **HCES dietary data, (n households)** | **Study sample population (n)** | **Nutrient/ food item** | **Individual intake** | **HCES AME apparent intake** | **Percentage point Difference** |
| ***I. Study compared intake estimates derived from individual-level versus HCES dietary data*** |
| Karageorgou *et al.* (2018) (38);Bangladesh;means | 24H recall of household meals and proportions consumed by individuals(N=22,173) | 7-day recall of household meals(n=5503) | Children (<5 years)(n=2807) | Energy, kcal | 880 | 1130 | 28 |
| Protein, g | 22 | 28 | 26 |
| Carbohydrates, g | 164 | 216 | 32 |
| Total fat, g | 13 | 15 | 10 |
| Vitamin A RAE, μg | 108 | 158 | 47 |
| Vitamin D, μg | 0.5 | 0.6 | 40 |
| Vitamin E, mg | 2.0 | 2.6 | 30 |
| Thiamine, mg | 0.3 | 0.4 | 33 |
| Riboflavin, mg | 0.3 | 0.3 | 10 |
| Niacin, mg | 5.7 | 7.8 | 37 |
| Vitamin B6 | 0.5 | 0.7 | 40 |
| Folate, μg | 55 | 76 | 40 |
| Vitamin C, mg | 18 | 32 | 80 |
| Calcium, mg | 151 | 166 | 10 |
| Iron, mg | 4.2 | 5.8 | 38 |
| Sodium, mg | 1960 | 2887 | 47 |
| Potassium, mg | 621 | 850 | 37 |
| Magnesium, mg | 132 | 184 | 40 |
| Zinc, mg | 3.6 | 4.8 | 31 |
| Lividini *et al.* (2013) (40);Rajshahi, Bangladesh;medians | 2 non-consecutive days of 12-hour observed weighed food records & 12-hour dietary recall (n=477)  | 14-day food diary of households with children age 2-3 (n=513) | Children (2-3 years)(n=237) | Energy, kcal | 905 | 1098 | 18 |
| Lividini *et al.* (2013) (40);Dhaka, Bangladesh;medians | 2 non-consecutive days of 12-hour observed weighed food records & 12-hour dietary recall (n=464) | 14-day food diary of households with children age 2-3 (n=678) | Children (2-3 years)(n=226) | Energy, kcal  | 868 | 1104 | 21 |
| ***II. Study compared consumption of fortified food vehicles derived from individual-level versus HCES dietary data*** |
| Engle-Stone & Brown (2015) (18);Cameroon;medians | 24H individual recall(N=1794) | Combination of 3 to 7 day recalls and 15-day diary depending on sub-population, different survey sample(n=4363) | Children (12-59 months) (n=882) | Refined oil, g | 11.7 | 6.2 | -89 |
| Wheat flour, g  | 49.4 | 24.2 | -104 |
| Sugar, g  | 19.6 | 7.2 | -172 |
| Bouillon, g  | 0.9 | 1.3 | 31 |
| Dary & Jariseta (2012) (11);Kampala, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=314) | Children (2-5 years) | Vegetable oil, g  | 4.9 | 7.0 | 30 |
| Wheat flour, g  | 36.2 | 16.0 | -126 |
| Sugar, g  | 38.2 | 24.9 | -53 |
| Maize flour, g | 49.1 | 24.3 | -102 |
| Rice, g | 43.8 | 20.5 | -114 |
| Dary & Jariseta (2012) (11);Southwestern Region, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=322) | Children (2-5 years) | Vegetable oil, g  | 5.7 | 5.0 | -14 |
| Wheat flour, g  | 32.4 | 7.5 | -332 |
| Sugar, g  | 23.5 | 11.6 | -103 |
| Maize flour, g | 41.8 | 27.0 | -55 |
| Rice, g | 33.1 | 18.1 | -83 |
| Dary & Jariseta (2012) (11);Northern Region, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=321) | Children (2-5 years) | Vegetable oil, g  | 9.4 | 3.8 | -147 |
| Wheat flour, g  | 26.2 | 3.3 | -694 |
| Sugar, g  | 25.0 | 6.7 | -273 |
| Maize flour, g | 69.4 | 10.7 | -549 |
| Rice, g | 27.7 | 9.7 | -186 |

# **Table S5.** Publications comparing apparent nutrient, energy or fortifiable food item intake estimates using HCES adult male equivalent methods to intake estimates calculated using individual-level dietary intake data for women of reproductive age (WRA)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference;** **country;** **summary metric** | **Individual dietary assessment data (N)** | **HCES dietary data,** **(n households)** | **Study sample population (n)** | **Nutrient/ food item** | **Individual intakes** | **HCES AME apparent intakes** | **Percentage point difference** |
| ***I. Study compared intake estimates derived from individual-level versus HCES dietary data*** |
| Karageorgou *et al.* (2018) (38);Bangladesh;means | 24H recall of household meals and proportions consumed by individuals(N=22,173) | 7 day recall of household meals(n=5503) | Women (n=11,671) | Energy, kcal | 1965 | 2180 | 11 |
| Protein, g | 48 | 53 | 12 |
| Carbohydrates, g | 379 | 416 | 10 |
| Total fat, g | 24 | 29 | 17 |
| Vitamin A RAE, μg | 210 | 307 | 46 |
| Vitamin D, μg | 1.1 | 1.2 | 18 |
| Vitamin E, mg | 4.3 | 5.1 | 19 |
| Thiamine, mg | 0.7 | 0.9 | 14 |
| Riboflavin, mg | 0.4 | 0.5 | 25 |
| Niacin, mg | 13.4 | 15 | 11 |
| Vitamin B6 | 1.1 | 1.3 | 18 |
| Folate, μg | 115 | 148 | 29 |
| Vitamin C, mg | 41 | 62 | 52 |
| Calcium, mg | 260 | 324 | 25 |
| Iron, mg | 9.4 | 11.3 | 20 |
| Sodium, mg | 4096 | 5538 | 35 |
| Potassium, mg | 1329 | 1646 | 24 |
| Magnesium, mg | 306 | 354 | 16 |
| Zinc, mg | 8.2 | 9.2 | 12 |
| Lividini *et al.* (2013) (40);Rajshahi, Bangladesh;medians | 2 non-consecutive days of 12-hour observed weighed food records & 12-hour dietary recall (n=477)  | 14-day food diary of households with children age 2-3 (n=513) | WRA(n=240) | Energy, kcal | 1984 | 2281 | 13 |
| Lividini *et al.* (2013) (40);Dhaka, Bangladesh;medians | 2 non-consecutive days of 12-hour observed weighed food records & 12-hour dietary recall (n=464) | 14-day food diary of households with children age 2-3 (n=678) | WRA(n=238) | Energy, kcal | 1693 | 2329 | 27 |
| ***II. Study compared consumption of fortified food vehicles derived from individual-level versus HCES dietary data*** |
| Engle-Stone & Brown (2015) (18);Cameroon;medians | 24H individual recall(N=1794) | Combination of 3 to 7 day recalls and 15-day diary depending on sub-population, different survey sample(n=4363) | WRA(n=912) | Refined oil, g  | 19.6 | 13.3 | -47 |
| Wheat flour, g  | 76.6 | 51.2 | -50 |
| Sugar, g  | 29.2 | 15.5 | -88 |
| Bouillon, g  | 1.9 | 2.7 | 30 |
| Dary & Jariseta (2012) (11);Kampala, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=314) | WRA (15-49 years) | Vegetable oil, g  | 10.4 | 12.8 | 19 |
| Wheat flour, g  | 58.3 | 29.3 | -99 |
| Sugar, g  | 55.5 | 45.6 | -22 |
| Maize flour, g  | 115.9 | 44.4 | -161 |
| Rice, g  | 63.0 | 37.5 | -68 |
| Dary & Jariseta (2012) (11);Southwestern Region, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=322) | WRA (15-49 years) | Vegetable oil, g | 10.9 | 9.1 | -20 |
| Wheat flour, g | 35.3 | 13.7 | -158 |
| Sugar, g | 40.3 | 21.2 | -90 |
| Maize flour, g | 78.6 | 49.4 | -59 |
| Rice, g  | 81.3 | 33.1 | -146 |
| Dary & Jariseta (2012) (11);Northern Region, Uganda;medians | 24H individual recall | 7-day recall of household meals(n=321) | WRA (15-49 years) | Vegetable oil, g | 18.8 | 7.0 | -169 |
| Wheat flour, g | 35.6 | 6.1 | -484 |
| Sugar, g | 39.4 | 12.3 | -220 |
| Maize flour, g | 130.3 | 19.6 | -565 |
| Rice, g | 84.4 | 17.7 | -377 |

# **Appendix 1.** Original protocol of systematic review developed according to PRISMA guidelines

[Original protocol attached as a separate document]

[PRISMA checklist attached as a separate document]

# **Appendix 2.** Search algorithms returning publications in database search

|  |  |
| --- | --- |
| Database | Search Algorithm |
| Web of Science | TOPIC: (hces) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: (household consumption and expenditure survey) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: (lsms) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("living standards measurement study") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("integrated household survey") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("household budget survey") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("living conditions monitoring survey") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("socioeconomic survey") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("national risk and vulnerability assessment") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("core welfare indicators") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("enquête" AND "auprès des ménages") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("enquête" AND "les conditions de vie") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.TOPIC: ("enquête" AND "le budget et la consommation des ménages") Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI. |
| PubMed | Search: “household consumption and expenditure survey” AND “food consumption”Search: “household consumption and expenditure survey” AND nutr\*Search: "integrated household survey"Search: "living standards measurement study"Search: "living conditions monitoring survey" AND “food consumption”Search: "living conditions monitoring survey" AND nutr\*Search: "national risk and vulnerability assessment"Search: "core welfare indicators questionnaire" |
| AgEcon | Query : "household consumption and expenditure survey"Query : "living standards measurement study"Query : “household budget survey” AND nutr\*Query : “household budget survey” AND vitaminQuery : “household budget survey” AND mineralQuery : “household budget survey” AND micronutrientQuery : “household budget survey” AND energy intakeQuery : “income and expenditure survey” AND nutr\*Query : “income and expenditure survey” AND vitaminQuery : “income and expenditure survey” AND mineralQuery : “income and expenditure survey” AND micronutrientQuery : “income and expenditure survey” AND energy intakeQuery : "living conditions monitoring survey"Query : "integrated household survey" |
| GARDIAN CGIAR | household consumption and expenditure surveyliving standards measurement study“integrated household survey” AND nutri\*living conditions monitoring surveyhousehold budget survey |
| AGRIS | Query : "household consumption and expenditure survey"Query : "living standards measurement study"Query : “household budget survey” AND nutri\*Query : “household budget survey” AND energyQuery : “household budget survey” AND vitaminQuery : “household budget survey” AND mineralQuery : “household budget survey” AND micronutrientQuery : “income and expenditure survey” AND nutri\*Query : “income and expenditure survey” AND energyQuery : “income and expenditure survey” AND vitaminQuery : “income and expenditure survey” AND mineralQuery : “income and expenditure survey” AND micronutrientQuery : “integrated household survey” |
| JSTOR | ((“household consumption and expenditure survey”) AND (nutr\*))((("living standards measurement study") AND (food)) AND (consumption))(("living standards measurement study") AND (nutr\*))((("integrated household survey") AND (food)) AND (consumption))((("integrated household survey") AND (nutr\*)))((("integrated household survey") AND (micronutrient)))((“living conditions monitoring survey”) AND (nutr\*)) |
| IFPRI Publications & Tools Database | household consumption and expenditure surveyliving standards measurement studyintegrated household surveyliving conditions monitoring surveyhousehold budget surveysocioeconomic surveynational risk and vulnerability assessment |
| Academic Search Complete | household consumption and expenditure surveyintegrated household surveyliving standards measurement studyhousehold budget surveyliving conditions monitoring surveyhousehold income and expenditure survey |
| EconLit | (household consumption and expenditure survey).mp. [mp=heading words, abstract, title, country as subject](living standards measurement study).mp. [mp=heading words, abstract, title, country as subject](integrated household survey).mp. [mp=heading words, abstract, title, country as subject](living conditions monitoring survey).mp. [mp=heading words, abstract, title, country as subject](socioeconomic survey).mp. [mp=heading words, abstract, title, country as subject](national risk and vulnerability assessment).mp. [mp=heading words, abstract, title, country as subject](core welfare indicators questionnaire).mp. [mp=heading words, abstract, title, country as subject] |
| Global Health Database | (household consumption and expenditure survey).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]living standards measurement study.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]integrated household survey.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]living conditions monitoring survey.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes](household budget survey AND nutri\*).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]socioeconomic survey.mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes] |
| Global Index Medicus | search: household consumption AND expenditure surveysearch: tw:("living standards measurement study")search: integrated household surveysearch: living conditions monitoring surveysearch: tw:(socioeconomic survey AND (energy OR calor\*)) AND (la:("en")) AND (year\_cluster:[2000 TO 2020]) |
| Scopus | TITLE-ABS-KEY (household AND consumption AND expenditure AND survey AND nutri\*)TITLE-ABS-KEY ("living standards measurement study")TITLE-ABS-KEY (household AND budget AND survey AND nutri\*)TITLE-ABS-KEY (living AND conditions AND monitoring AND survey)TITLE-ABS-KEY (integrated AND household AND survey AND nutri\*) |
| BASE | search: "household consumption and expenditure survey"search: "living standards measurement study" AND \*nutri\*search: "integrated household survey" AND \*nutri\*search: "living conditions monitoring survey"search: household budget survey AND \*nutri\*search: "socioeconomic survey" AND \*nutri\* |
| Google Scholar | search: "Enquête" AND "nutrition" AND "auprès des ménages"search: "Enquête" AND "nutrition" AND "les conditions de vie" AND "auprès des ménages"search: "Enquête" AND "nutrition" AND "Suivi de la Pauvrete"search: "Enquête" AND "nutrition" AND " la Consommation et le Secteur Informel"search: "Enquête” AND "nutrition" AND "le Budget et la Consommation des Menages" |

# **Appendix 3.** Information extracted from the included literature

|  |  |
| --- | --- |
| **Categories** | **Extracted information** |
| General information | * Title
* Year published
* Authors
* Journal/publication medium
* Peer review (Y/N)
* Objective
* Reported principal findings
* Reported limitations of analysis
 |
| Question 1: What is the scope of the existing literature? | Scope* Country(s) of study
* Name of survey
* Data collection time period
* Households, N
* Dietary data collection method
* Which nutrients were measured (or energy)?

Quality* Recall period
* Food item list, n
* Survey question verb
* Conversion to standard units?
* Edible portions of foods? How?
* Outliers identified? How?
* Which food composition tables were used and in what priority?
 |
| Question 2: What metrics have been used to estimate nutrient and energy supply/apparent intake and nutrient adequacy from HCES data, and how those estimates compare across metrics? | * What nutrition metric was used?
* Household or individual level?
* Was energy requirement calculation necessary for metric? If yes:
	+ What was the physical activity level parameter?
	+ What was the body weight parameter?
	+ Account for pregnancy? How?
	+ Account for lactation? How?
* Did analysis measure inadequacy?
	+ What method was used to determine inadequacy?
	+ Was dietary reference value necessary? Which was used?
* For certain nutrients, account for bioavailability?
 |
| Question 3: How do HCES-derived estimates of apparent nutrient and energy intake compare to those estimated using individual-level dietary assessment methods? Do results differ by age group (i.e. adults, adolescents, children, infants)? | * Name of HCES
* Data collection time period
* Households, N
* Individual dietary assessment methods
	+ Participants, n
	+ Members of households?
	+ Retrospective or prospective?
	+ Number of visits
* Apparent nutrient/energy intake estimate from HCES
* Nutrient/energy intake estimate from individual dietary assessment
* Difference in nutrient/energy intake vs. apparent nutrient/energy intake
* Measured inadequacy?
* Difference in inadequacy prevalence between HCES and individual assessments
* Disaggregated by age groups?
	+ Difference in nutrient/energy intake vs. apparent nutrient/energy intake by age group
* Disaggregated by gender?
	+ Difference in nutrient/energy intake vs. apparent nutrient/energy intake by sex
 |
| Question 4: What types of sub-group comparative analyses have been conducted using nutrient and energy supply/apparent intake estimates from HCES data? (PROGRESS+ framework) | Disaggregation of results by:* Place of residence
* Race/ethnicity
* Occupation
* Gender
* Religion
* Education
* Socioeconomic status
* Social capital
* + (personal characteristics)
 |

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