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1 **Comparison of food consumption in Indian adults between national and**
2 **sub-national dietary data sources**

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11

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18

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24

25 **Abstract**

26 Accurate data on dietary intake are important for public health, nutrition and agricultural policy.
27 The National Sample Survey (NSS) is widely used by policymakers in India to estimate nutritional
28 outcomes in the country, but has not been compared to other dietary data sources. To assess
29 relative differences across available Indian dietary data sources, we compare intake of food groups
30 across six national and sub-national surveys between 2004-2012, representing various dietary
31 intake estimation methodologies, including household consumer expenditure surveys (HCESs),
32 food-frequency questionnaires (FFQs), food balance sheets (FBSs), and 24-hour recall (24HR)
33 surveys. We matched data for relevant years, regions, and economic groups, for ages 16-59. One
34 set of national HCESs and the 24HRs showed a decline in food intake in India between 2004/2005-
35 2011/2012, while another HCES and FBSs showed an increase. Differences in intake were smallest
36 between the two HCESs (1% relative difference). Relative to these, FFQs and FBS had higher
37 intake (13% and 35%), and the 24HR lower intake (-9%). Cereal consumption had high agreement
38 across comparisons (average 5% difference), while fruit and nuts, eggs, meat and fish, and sugar
39 had the least (120%, 119%, 56%, and 50% average differences, respectively). Spearman coefficients
40 showed high correlation of ranked food group intake across surveys. The underlying methods of the
41 compared data highlight possible sources of under- or over-estimation, and influence their
42 relevance for addressing various research questions and programmatic needs.

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49 **Introduction**

50 Accurate data on dietary intake are important for several policy areas, including nutrition,
51 agriculture, and public health. Three types of sources are generally used for estimating food
52 consumption in populations: food balance sheets (FBSs), household consumer expenditure surveys
53 (HCES), and individual intake surveys^(1,2). The Food and Agriculture Organisation (FAO) calculates
54 annual FBSs for countries, which estimate national-level availability of major food commodities, as
55 a function of production, imports, exports, and adjustments for waste. HCESs are conducted on a
56 frequent basis by national statistics offices, using nationally representative sampling frames, and
57 collect data on household-level purchases of a comprehensive set of food commodities. Individual
58 intake surveys come in a variety of designs, including food frequency questionnaires (FFQs), 24-
59 hour recall (24HR) surveys, and weighed food records. These surveys are generally regarded as
60 providing more accurate individual-level estimates of food consumption than FBS or HCES, though
61 they are more difficult and expensive to conduct, and thus are more commonly used on specific
62 study populations rather than at national levels⁽¹⁾. The choice of data type used by researchers and
63 policymakers often depends on availability.

64

65 Much nutritional research has focused on India, where historically high rates of under-nutrition, as
66 well as growing over-nutrition, impose heavy burdens on health and development⁽³⁻⁵⁾. Several data
67 sources exist in the country on dietary intake, and they have been variously used to study and
68 describe, for example, consumption of major food groups and associated changes over time^(4,6-10),
69 absolute micronutrient intake⁽¹¹⁾, and health outcomes related to nutritional intake^(12,13), among
70 others^(14,15).

71

72 Specifically, the Indian government's National Sample Survey (NSS) HCESs have been used to
73 describe the country's dietary transition from the 1980s to 2000s^(4,7). It has been suggested that

74 several stages of transition with varying characteristics have unfolded in the country^(6,9), though on
75 the whole, diets have seen a decline in cereals, and an increase in calories from vegetable- and
76 animal-source fats. Alongside changes in food consumption over these years, recent estimates
77 show that in 2014, about 27% of Indian adults were overweight, while 39% of children under 5
78 were stunted⁽¹⁶⁾. Despite India's growing economy, reductions in undernutrition have been
79 materialising slowly⁽¹⁷⁾.

80

81 However, challenges remain in using Indian dietary data to explain nutritional trends and drivers.

82 Overall trends in dietary intake across time are still not fully clear, partly due to a lack of reliable
83 data⁽⁸⁾. The NSS has shown a steady and counterintuitive decrease in consumed calories since the
84 1980s to 2010 as incomes have grown, with a small rebound in caloric intake only in the last
85 available data year of 2012^(8,18). Evidence suggests the recent decreasing caloric trends in these
86 data may be a function of some underestimation in this survey, such as not fully accounting for
87 increased consumption of food outside the home^(19,20).

88

89 Measuring food consumption is generally a difficult exercise⁽²¹⁾, and studies have shown that the
90 choice of data methodology applied to a given population can affect the resulting intake
91 estimates^(20,22-25). Intake data are therefore often compared against an alternative method for a
92 given sample or population for the purposes of validation, or to determine relative differences
93 between the compared methods^(2,22-26). Despite researchers' and policymakers' reliance on the NSS,
94 it has not been compared to other sources of dietary data in the country.

95

96 We compare intake of major food groups using six national and sub-national sources of Indian food
97 consumption, representing various dietary intake estimation methods, and assess the impact of
98 these methods on relative differences in food consumption.

99 **Methods**

100 **Data**

101 *National Sample Survey (NSS)*

102 The NSS is an annual, nationally representative HCES, representing a random sample of households
103 across the country. The questionnaire records the quantity and value of approximately 250 food
104 and beverage items purchased in the last 30 days, among other consumer goods^(18,27). We used
105 rounds 61, 66, and 68 of the survey, conducted between July and June of 2004-5, 2009-10, and
106 2011-12, respectively, to match the years of data collection as close as possible to our other
107 compared data sources. We additionally compare the 2011-2012 data from an alternative NSS
108 survey format (named “type 2”) that was recently implemented and used 7-day recall for meats,
109 eggs, oils, fruits, and vegetables (though it retained a 30-day recall for cereals, pulses, and sugar)⁽²⁷⁾.

110

111 *India Health and Development Survey (IHDS)*

112 The IHDS was a nationally representative HCES, conducted over two waves in 2004-2005 and 2011-
113 12. It recorded, among other socioeconomic and health indicators, the quantity and value of
114 purchased food groups in the last 30 days, such as vegetables, meats, and legumes, as well as
115 several commonly-consumed individual items, such as rice and wheat⁽²⁸⁾.

116

117 *FAO food balance sheets (FBSs)*

118 The FAO’s FBSs provide a picture of food availability at the national level, and approximate per
119 capita food availability by dividing national estimates by the total population⁽¹⁾. We retrieved data
120 for the years 2004, 2005, 2011, and 2012 from the FAOSTAT database⁽²⁹⁾.

121

122 *National Nutrition Monitoring Bureau (NNMB) rural surveys*

123 The National Nutrition Monitoring Bureau conducts periodic surveys in ten Indian states, using
124 multi-stage random sampling of households, and following the NSS sampling frame. The surveys
125 recorded individual-level intake within households using one 24HR survey⁽³⁰⁾. The raw data from
126 these surveys were not available, though NNMB reports provide mean individual-level intake of
127 food groups by age for rural areas. We used these reported data for adults aged 18 and above,
128 from the surveys conducted on rural populations during 2004-2005 and 2011-2012^(31,32).

129

130 *Indian Migration Study (IMS)*

131 The IMS was a health and nutrition study conducted in 2005-2007, which surveyed factory workers
132 in the four urban centres of Hyderabad, Bangalore, Nagpur and Lucknow, and their siblings living in
133 rural areas, the majority of whom resided within the same Indian state as the urban centre. The
134 survey used a FFQ of 184 dishes and food items, and recorded the frequency of intake and number
135 of servings of each item in the one-year period prior to the survey. The study also collected recipes
136 for each of the FFQ items, separately for rural and urban areas of each study site⁽³³⁾.

137

138 *Andhra Pradesh Child and Parent Study (APCAPS)*

139 APCAPS is a prospective birth cohort study of households in 29 peri-urban villages of Ranga Reddy
140 district in the Indian state of Telangana (previously Andhra Pradesh) that earlier took part in a food
141 supplementation trial involving pregnant women and their offspring (1987-90). It uses a FFQ of 98
142 dishes and food items, based on the IMS FFQ and further refined for use in the APCAPS study
143 setting. Here we used the third follow-up wave, which included children and their parents,
144 conducted between 2010-2012⁽³⁴⁾. The first wave was excluded as it did not collect detailed data on
145 intake, while the second wave had a smaller sample size consisting of only children.

146

147 All data sources accounted for seasonality by using aggregated annual data or conducting fieldwork
148 throughout the year (NSS, IHDS, FBS, NNMB), or by specifically recording the variation in intake by
149 time of year (IMS, APCAPS). A summary of data sources, including sample sizes, is presented in
150 Table 1.

151

152 **Analysis**

153 We compare intake of major food groups, in grams/person/day, between survey types, matching
154 for relevant year of survey, regions, sex, and economic groups, where available. HCESs were used as
155 the reference comparison against other methodologies (though strictly to assess relative
156 differences rather than as a source of validation) due to the larger number of HCES datasets and
157 the ability to match across the years and regions of other survey types. Food groups compared
158 were cereals, pulses, dairy (including butter), vegetable oils, meat (including fish), eggs, fruits and
159 nuts, and vegetables (including root vegetables). Beverages were excluded. Intake was calculated
160 for adults aged 16-59, for men and women combined (NNMB data were only available for ages 18
161 and over), though stratification by age was not possible for FAO data.

162

163 Household expenditure surveys were converted to individual intake using Indian caloric
164 requirement adjustment factors based on age and sex⁽³²⁾, and we used household weights to scale
165 up to the national level. In the NSS data we additionally adjusted for high-income households which
166 provide food to poorer households in exchange for labour or services, based on a standard
167 methodology recommended by the NSS⁽¹⁸⁾. We converted intake of the IMS and APCAPS FFQ items
168 into individual food intake using the recipe sheets generated for these surveys, and aggregated
169 these foods into food groups. Intake of each food group in the IMS data was additionally adjusted
170 based on the validation of the IMS against a series of three 24HR surveys⁽²⁶⁾. Data from the FAO and
171 NNMB surveys were extracted from publicly-available reports, and aggregated into the relevant

172 food groups. FAO data were averaged for the years 2004-5, and 2011-12, to match the
173 corresponding NSS and IHDS survey rounds. The IMS (conducted during 2005-7) and APCAPS (2010-
174 12) asked respondents to recall intake over the previous year, and we have therefore used the
175 years of intake in these surveys as 2004-6 and 2009-11, respectively, and matched these data for
176 comparison to the IHDS-1 conducted in 2004-2005, and the NSS 66 conducted in 2009-10.

177

178 Comparisons using the Indian Migration Study were additionally stratified by income groups, as the
179 employed IMS respondents and their siblings may have represented a higher socioeconomic sample
180 than the average Indian population. For this, we generated a common standard of living index (SLI)
181 between the IHDS and IMS, based on the SLI methodology developed in the Indian National Family
182 Health Survey (NFHS)⁽³⁵⁾. The components of this index include ownership of various assets and
183 utilities, and we compared intake between the surveys for SLI tertiles. APCAPS data were compared
184 to NSS rural households in Ranga Reddy district. Although matching for the same specific APCAPS
185 villages was not possible in the NSS, the mean SLI between the APCAPS sample and the district-level
186 NSS sample was very similar.

187

188 Relative differences in total daily intake, and for individual food groups (both in grams/day), were
189 calculated for each dietary intake method comparison. We were not able to assess the statistical
190 significance of the comparisons, as FAO and NNMB data do not allow for standard error
191 calculations, and the main underlying uncertainty for all the methods is likely to be a function of
192 measurement error rather than sample size. Spearman coefficients assessed the similarity of
193 ranked food group intake across comparisons.

194

195 Ethics committee approval for IMS was obtained from the All India Institute of Medical Sciences
196 Ethics Committee, and for APCAPS from the National Institutes of Nutrition, Hyderabad, and Public

197 Health Foundation of India, New Delhi. Ethics committee approval for this analysis was obtained
198 from the London School of Hygiene and Tropical Medicine. Consent was sought from the factory
199 managers for the Indian Migrant Study and from the community leaders in the villages for the
200 APCAPS study.

201

202 **Results**

203 Individual intake of food groups was calculated for twelve Indian national and sub-national data
204 sources, conducted between 2004-2012, representing four dietary intake estimation methods
205 (Table 1).

206

207 *National-level trends over time*

208 Both the NSS and NNMB surveys showed a decline nationally in total intake of food, in grams/day,
209 between 2004/5-2011/12, though the IHDS and the FAO FBSs showed an overall increase over the
210 same years (Figure 1). Changes in food group consumption between 2004-2012 were mostly
211 consistent across the NSS, IHDS, and FAO data; nationally, sources showed an increase in intake of
212 pulses, dairy, fats, eggs (no change in IHDS data), meat and fish, and sugar, and a decrease in
213 cereals (no change in the FAO data). Intake of fruits and vegetables showed a decrease in NSS, and
214 an increase in IHDS and FAO data. The IHDS, NSS, and IMS recorded higher overall intake in
215 grams/person/day in urban than rural areas, for all available survey rounds (Supplementary figures
216 3 and 4).

217

218 In 2012, the most recent year of data availability, intake (in kg) in India was highest for cereals
219 (about 30-45%, depending on the data source), while consumption of dairy and vegetables was also
220 high (about 20-25%). Eggs and meat constituted the lowest intakes (2% or less), and consumption
221 of pulses, oil, and sugar were also low (about 3-5%) (Figure 1).

222

223 *Overall differences across survey types*

224 Relative differences in combined intake of all food groups across the individual data comparisons
225 varied markedly, and ranged from 1% between the IHDS-1 and the corresponding NNMB 24HR
226 survey, to 50% between the NSS round 68 and FAO FBSs. The IHDS and NSS expenditure surveys
227 were similar to each other, showing a relative difference in total intake of just 1%, averaged across
228 the two rounds of the surveys. Compared to HCEs, FFQs and FBSs showed higher absolute intake
229 (on average, by 13% and 35%, respectively), and the 24HR surveys lower intake (average of -9%)
230 (Table 2).

231

232 Type 1 and 2 formats were compared for round 68 of the NSS data (2011-2012). The type 2 survey
233 showed substantially higher intake for those foods surveyed with the 7-day recall (vegetable oils,
234 eggs, meat & fish, vegetables, and fruit & nuts; with increases of 9%, 66%, 43%, 48%, and 63%,
235 respectively). Intake for the remaining foods that retained the 30-day recall in type 2 (cereals,
236 pulses, and sugar) showed minor relative differences of about 1% compared to the same 30-day
237 recall of these foods in the type 1 survey (Supplementary figure 5).

238

239 *Food group differences across survey types*

240 Of all food groups, intake of cereals showed the smallest relative differences in grams/person/day
241 across the survey comparisons, ranging from -1 to 9%, with an average difference of 5%. Fruit and
242 nuts, eggs, meat and fish, and sugar had high average relative differences across the comparisons
243 (120%, 119%, 56%, and 50% average differences, respectively). Fruit and nuts in particular had the
244 highest variability in differences between comparisons, ranging from a -36% difference between
245 the NSS and IHDS HCEs, to a 264% difference between the expenditure surveys and FBSs (Table 3).

246

247 Spearman correlation analysis of food group ranks (intake of a food group as the proportion of total
248 intake in kg) showed very high correlation across surveys (Spearman's rho 0.8-1.0 across surveys,
249 $p=0.01$ to $p<0.0001$).

250

251 **Discussion**

252 We present a comparison of several sources of Indian dietary data, representing a variety of intake
253 estimation methods. This is, to our knowledge, the first such analysis. We found differences in
254 estimates of overall and food group intake across these comparisons when matching sources for
255 year, sex, and region, which may be partly due to methodological differences across the surveys.

256

257 Compared to the national consumer expenditure surveys, relative differences in total estimated
258 intake in grams/person/day varied from 1% to 50% across the other data sources. The two national
259 expenditure surveys were most similar to each other, while the FFQs and FBS showed higher intake,
260 and the 24HR surveys lower intake, in relation to these. Cereal consumption had high agreement
261 across survey types, while fruit and nuts, eggs, meat and fish, and sugar had the least.

262

263 Recent work has suggested that the Indian expenditure and 24HR surveys may to some degree
264 underestimate food consumed out of home⁽¹⁹⁾, and this could partly explain the lower consumption
265 recorded in these sources relative to FFQ and FBS data. The NSS records the value and number of
266 snacks and meals, respectively, eaten out of the home from a single respondent (and IHDS records
267 only the value of meals). This is generally the female adult of the household who recalls other
268 household members' intake⁽¹⁹⁾, and may therefore not be aware of some foods eaten out of the
269 home^(20,36,37). The NNMB 24HR surveys share a similar limitation, and to our knowledge, do not
270 provide details on how the nutritional composition of recalled food is determined, or how food
271 outside the home is accounted for. However, the NSS is the longest-running source of nationally

272 representative data, and is frequently used to analyse consumption trends in India. Two factors
273 may help improve estimates of dietary intake from these expenditure data. First is the use of the
274 “type 2” data, in which the use of a shorter recall period may help improve accuracy^(27,38),
275 particularly for nutrient-rich food groups. We calculated a 13% higher total intake in grams per
276 person per day across all foods, and NSS-own estimates show about 6-9% higher caloric intake in
277 rounds 66 and 68, when compared to the typical “type 1” 30 day recall^(18,27). Secondly, our
278 calculations showed about 7-8% of NSS households’ food expenditure was spent on snacks and
279 food prepared outside the home (data not shown), and methods are needed to estimate intake
280 from these sources. The two most recent NSS rounds have improved the specificity of food types
281 eaten out of home^(18,27), and while the survey provides the average estimated caloric, fat and
282 protein composition of these items, the data format still does not allow for direct intake estimates
283 of food groups or key nutritional indicators such as sugar, salt, or micronutrients.

284

285 The decline in overall intake between 2004/5 and 2011/12 in the NSS and NNMB data was not seen
286 in the FAO FBSs or the IHDS expenditure surveys. The FAO captures all food available at the national
287 level, and may better assess all available food regardless of where it was purchased or eaten,
288 though as the IHDS shares similar methodology to the NSS expenditure survey, it is not clear why
289 they diverged on the direction of overall intake.

290

291 FAO FBS data have been shown to generally overestimate per capita intakes^(2,25,39), as they may not
292 fully account for wastage along the value chain from production up to consumption⁽²⁵⁾. However,
293 the FBSs are a common source for assessing trends over time in food availability⁽²⁾. Comparisons of
294 FBSs to other data sources have found that despite the general overestimation, FBSs can
295 underestimate intake of certain food groups^(23,25). In our study, the FBSs overestimated all food
296 groups relative to NSS and IHDS expenditure surveys.

297

298 FFQs have been shown to have variable performance compared to other reference methods, in
299 terms of direction and magnitude, though generally provide accurate ranking of food group
300 intake⁽²⁴⁾. FFQ characteristics such as the number of recall items and recall period affect their
301 accuracy⁽²⁴⁾. The IMS FFQ was calibrated against a series of three 24HR surveys⁽²⁶⁾, which are often
302 used as a reference standard. Our use of these adjustments lessened the differences between the
303 IMS and expenditure survey considerably, as the original IMS data showed almost 50% higher total
304 intake than the HCES. A similar validation was not undertaken for APCAPS, and this may explain
305 why the difference in intake between APCAPS and the HCES is higher than that between the IMS
306 and the HCES.

307

308 As each dietary data method was designed for select purposes, it is expected that the dietary
309 intakes in our comparisons would differ. Consumption of nutrient-rich food groups, as well as of
310 sugar, showed high degrees of variability between the various data sources. This observation
311 agrees with other recommendations that the dietary assessment methods we have reviewed may
312 not be appropriate for precise assessment of individual-level caloric or micronutrient intake⁽⁴⁰⁻⁴²⁾.
313 Instead, these data sources could be applicable for broader nutritional assessments, such as
314 relative comparisons between groups or identification of groups at nutritional risk, measures of
315 dietary diversity, time trends, categorization of dietary patterns, and selection of foods for
316 biofortification^(40,42,43). For example, the FFQ used in the IMS and APCAPS data was designed to
317 examine relative differences in food consumption, nutrition, and health across population groups,
318 and has been reported to be valid for such purposes⁽²⁶⁾. Our findings of high correlation in ranked
319 food group intake across all compared data sources also support these recommendations. Analyses
320 of dietary impacts on health require the use of data sources that contain information on potential
321 socioeconomic confounders, such as the IMS, APCAPS, and IHDS (though IHDS only include

322 anthropometric data, while IMS and APCAPS measured a range of health outcomes). However,
323 even within the recommended uses of these data, additional limitations may exist for populations
324 with unique dietary needs or intake patterns, such as children (for whom 24HRs or FFQs would
325 require knowledgeable respondent proxies, and difficult assumptions about individual allocation
326 from household-level surveys) and minority populations (where FFQs may not be reflective of
327 unique cultural foods). Users of these data sources should therefore examine their suitability for
328 purposes other than what the data were originally designed for. The most precise methods for
329 micronutrient and caloric intake remain doubly-labelled water, and in some cases, 7-day weighed
330 food records, though their use is limited by their cost and time requirements. As such, there may be
331 a trade-off between feasibility of national coverage and accuracy of individual-level intake. These
332 above points apply to any uses of the data, including for research or programmatic needs.

333

334 This comparison of Indian dietary data has some limitations. Firstly, it is not possible to validate the
335 individual data sources as no gold standard reference exists for our use, and therefore our
336 comparisons between sources are only in relative terms. We have matched data for major
337 characteristics such as year, region, sex, and socioeconomic levels, though other sampling factors
338 may have contributed to the differences in intake we have calculated, particularly for the non-
339 nationally representative data sources. The availability of data meant we could not compare all
340 survey types against each other for a given time period, and for this reason, we used the
341 expenditure surveys, for which several rounds are available, as the common reference comparison
342 to other data sources. The year of the data source may have differentially affected our
343 comparisons, for example, as increasing consumption out of home may have exacerbated
344 differences between HCES and FBS for the more recent time period. All data sources, except the
345 FBS, are also likely to suffer to some degree from recall bias. The conversion of HCES intake data
346 from the household to individual level may have introduced some bias, as differences in intra-

347 family food allocation likely exist⁽⁴⁴⁾ outside of age- and sex- derived caloric requirements. However,
348 despite these limitations, this is the first comparative analysis to bring these varied data sources
349 together, and this work should serve as a useful platform to inform the many future uses of these
350 data.

351

352 This analysis compares estimated food intake across several Indian data sources to contextualize
353 broad relative differences across dietary intake estimation methods. Each methodological choice
354 may have its own advantages and disadvantages for particular research uses, and further work is
355 required to suggest specific improvements for current Indian dietary data sources. Of general
356 usefulness would be the development of more comprehensive nutritional composition databases,
357 and improved methods in the on-going national surveys for measuring consumption out of home.
358 Also crucial is generation of high-quality data that can be used to validate or calibrate the various
359 current and future sources of dietary intake.

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375 Study and the Andhra Pradesh Children and Parents Study who took part in the research as well as
376 the study team in Hyderabad.

377

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383 writing of this article.

384

385 **Conflict of interest**

386 The authors declare that there are no conflicts of interest.

387

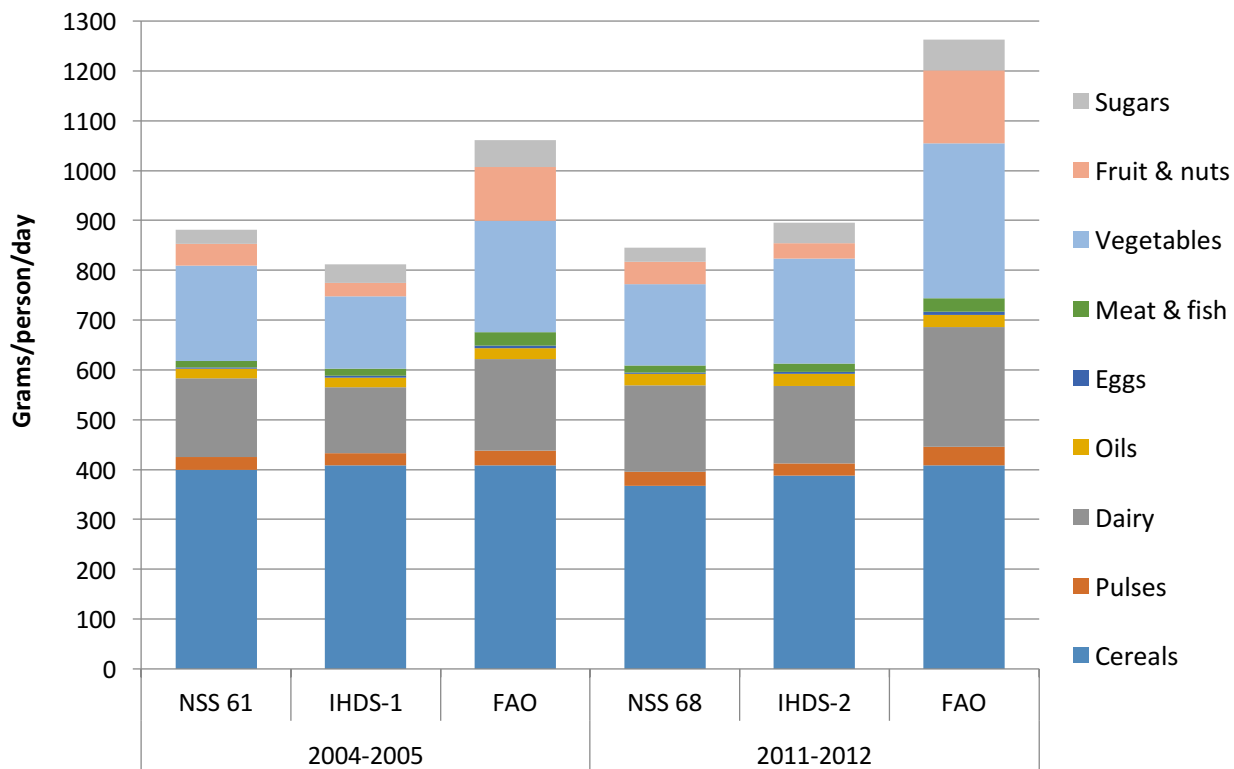
388 **Authorship**

389 LA and MT designed the study, and LA carried out the analysis, and drafted the paper. SK was
390 involved in data collection of the APCAPS, and shared the IMS and APCAPS data. LA has primary
391 responsibility for the final content. All authors were involved in data interpretation, critical
392 revisions of the paper, and approved the final version.

393

394 **Figures**

395 Figure 1: Consumption of food groups at the national level, recorded in household expenditure
 396 surveys (NSSO, IHDS) and food balance sheets (FAO), in 2004-5 and 2011-12.



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408 **Tables**409 **Table 1: Description of datasets**

	Data type	Year of survey	Region	Rural/urban	Recall period	Sample size
NSS 61	HCES	2004-2005	National	Both	30 days	353,561
NSS 66	HCES	2009-2010	National	Both	30 days	284,718
NSS 68	HCES	2011-2012	National	Both	30 days	285,954
NSS 68 type 2	HCES	2011-2012	National	Both	7 days*	285,695
IHDS-1	HCES	2004-2005	National	Both	30 days	124,355
IHDS-2	HCES	2011-2012	National	Both	30 days	121,622
IMS	FFQ	2005-2007	Hyderabad, Lucknow, Nagpur, Bangalore districts Rangareddy district,	Both	1 year	4,531
APCAPS-3	FFQ	2010-2012	Andhra Pradesh	Rural	1 year	6,273
NNMB	24HR	2004-2005	National**	Rural	24 hours	N/A
NNMB	24HR	2011-2012	National**	Rural	24 hours	N/A
FAO	FBS	2005-2006	National	Both	N/A	N/A
FAO	FBS	2011-2012	National	Both	N/A	N/A

NSS, National Sample Survey; HCES, Household consumption expenditure survey; IHDS, India Human Development Study; IMS, Indian Migration Study; FFQ, food frequency questionnaire; APCAPS, Andhra Pradesh Child and Parent Study; NNMB, National Nutrition Monitoring Bureau; 24HR, 24-hour recall; FAO, Food and Agriculture Organisation; FBS, food balance sheets.

*7-day recall for meats, eggs, oils, fruits, vegetables; 30-day recall for cereals, pulses, sugar.

**Data collected in 10 Indian states, sample not designed to be nationally-representative.

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421 **Table 2: Relative differences in absolute intake of all food groups (g/person/day) between survey**
 422 **types**

Reference survey	Intake g/d	Comparison survey	Intake g/d	% Difference
HCES vs. HCES (avg.)				-1%
NSS 61	881	IHDS-1	813	-8%
NSS 68	845	IHDS-2	895	6%
FFQ vs. HCES (avg.)				13%
IHDS-1	996	IMS	1052	6%
NSS 66	735	APCAPS	891	21%
FBS vs. HCES (avg.)				35%
NSS 61	881	FAO	1061	20%
NSS 68	845	FAO	1263	50%
IHDS-1	813	FAO	1061	31%
IHDS-2	895	FAO	1263	41%
24HR vs. HCES (avg.)				-9%
IHDS-1	735	NNMB	745	1%
IHDS-2	862	NNMB	712	-17%
NSS 61	807	NNMB	745	-8%
NSS 68	814	NNMB	712	-13%

423 HCES, Household consumption expenditure survey; NSSO, National Sample Survey Organisation; IHDS, India Human Development Study; FFQ, food frequency questionnaire; IMS, Indian Migration Study; APCAPS, Andhra Pradesh Child and Parent Study; FBS, food balance sheets; FAO, Food and Agriculture Organisation; 24HR, 24-hour recall; NNMB, National Nutrition Monitoring Bureau.

424 **Table 3: Relative differences in intake (g/person/day) of food groups between survey types**

	HCES vs. HCES	FFQ vs. HCES	FBS vs. HCES	24HR vs. HCES	Average*
Cereals	4%	-1%	5%	9%	5%
Pulses	-10%	41%	31%	25%	27%
Dairy	-13%	49%	37%	-34%	33%
Fats	1%	15%	11%	-28%	14%
Eggs	60%	212%	87%	N/A	119%
Meat & fish	11%	114%	83%	-17%	56%
Vegetables	3%	-24%	52%	-26%	26%
Fruit & nuts	-36%	182%	264%	-1%	120%
Sugar	44%	-24%	78%	-55%	50%

HCES, Household consumption expenditure survey; FFQ, food frequency questionnaire; FBS, food balance sheets; 24HR, 24-hour recall.

*Absolute magnitude, taking all relative differences as positive.

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