

Insights from India: Nudging behavioral intentions of food choice towards healthier diets



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Drivers of Food Choice
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INTRODUCTION

- EAT–Lancet Commission (2019): **Planetary health diets by 2050**
- Requires **food system transformation**
- Requires **behavioral change** at multiple levels of the food system
- We take a critical look at how **income shocks** and information condition **behavioral drivers** of food choice
- **Food Choice App (FCA)**: a tablet-based app for planning & budgeting weekly diets under budget constraints

RESEARCH ARTICLE

Open Access

A comparison of the Indian diet with the EAT-Lancet reference diet



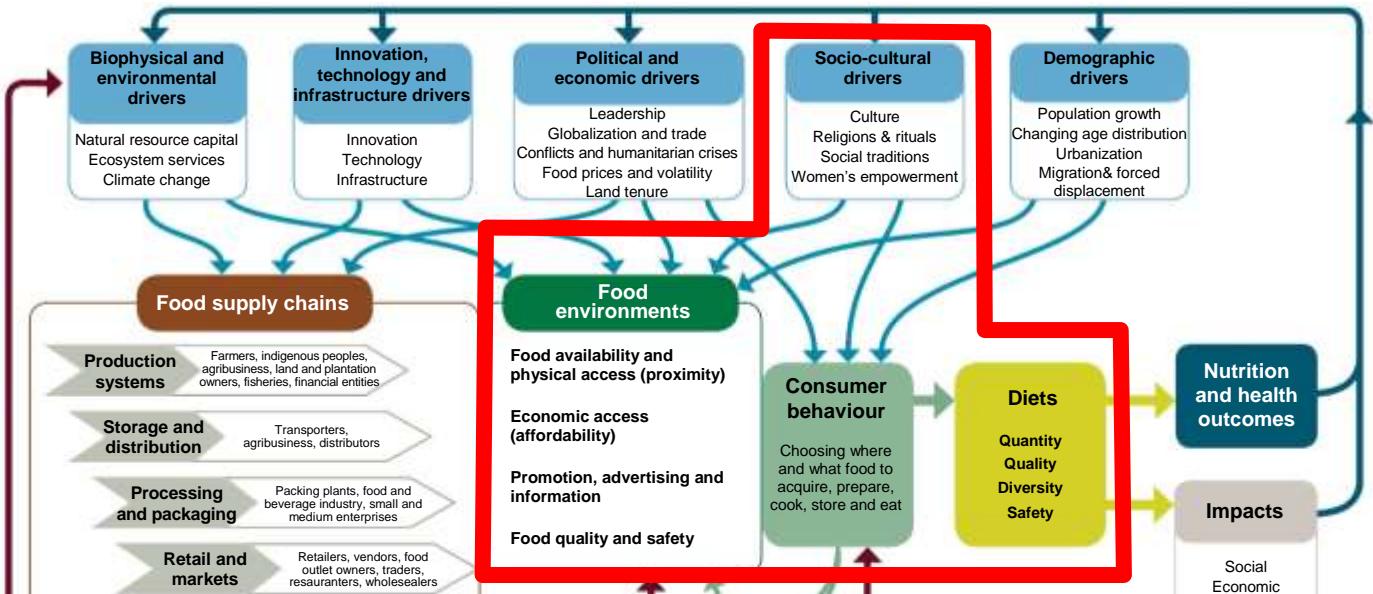
Manika Sharma* D, Avinash Kishore, Devesh Roy and Kuhu Joshi

Methods: The analysis was done using data from the Consumption Expenditure Survey (CES) of a nationally representative sample of 0.102 million households from 7469 villages and 5268 urban blocks of India conducted by

Conclusions: Indian diets, across states and income groups, are unhealthy. Indians also consume excess amounts of cereals and not enough proteins, fruits, and vegetables. Importantly, unlike many countries, excess consumption

of animal protein is not a problem in India. Indian policymakers need to accelerate food-system-wide efforts to make healthier and sustainable diets more affordable, accessible and acceptable.

THEORY



- Herforth & Ahmed (*FoodSec*, 2015): How income shocks translate into dietary quality is conditioned by the **food environment**.
- **Research question:** How does behavioral change communication (BCC) on healthy diets influence diets planned by households exposed to income shocks in a simulated digital food environment?

Source: High Level Panel of Experts for Food Security & Nutrition (HLPE), 2017

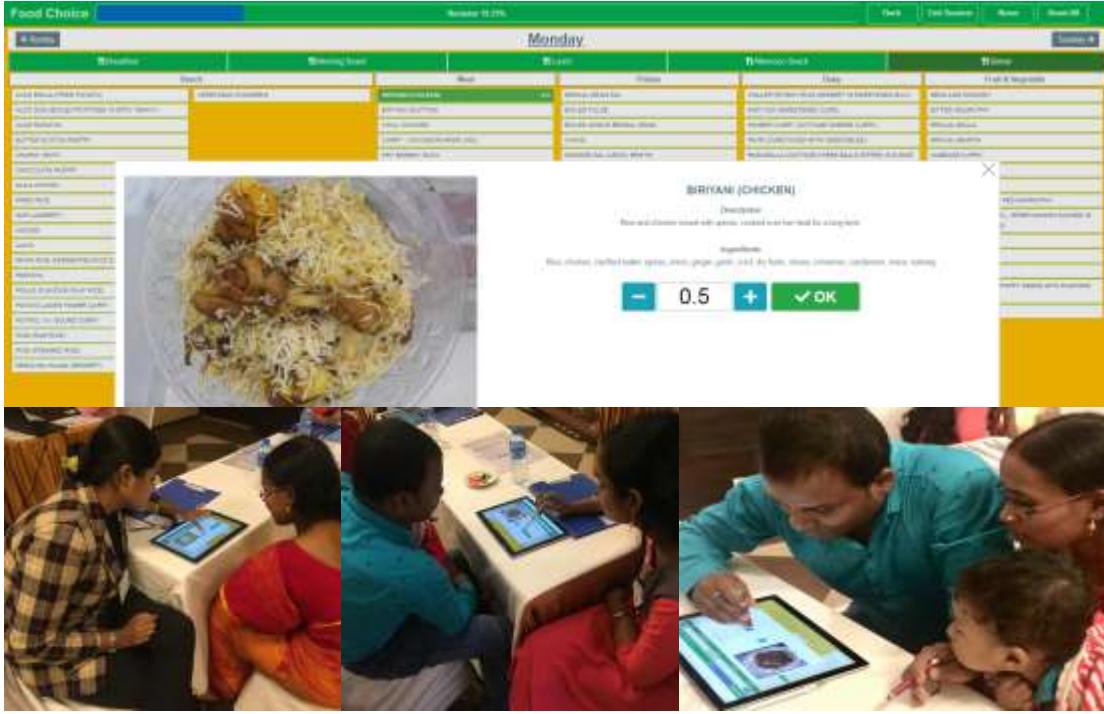
AVAILABILITY

ACCESS

UTILIZATION



Food Choice App (FCA)



- Designed to help households **budget** their weekly diets
- 155 unique dishes, 5 eating occasions, 7 weekdays
- Subject to **budget** constraint
- Fixed food budget depletes in real-time & compels households to **trade off** nutrition with affordability
- Sex-disaggregated collection of data with consensus round

3-STAGE APPROACH

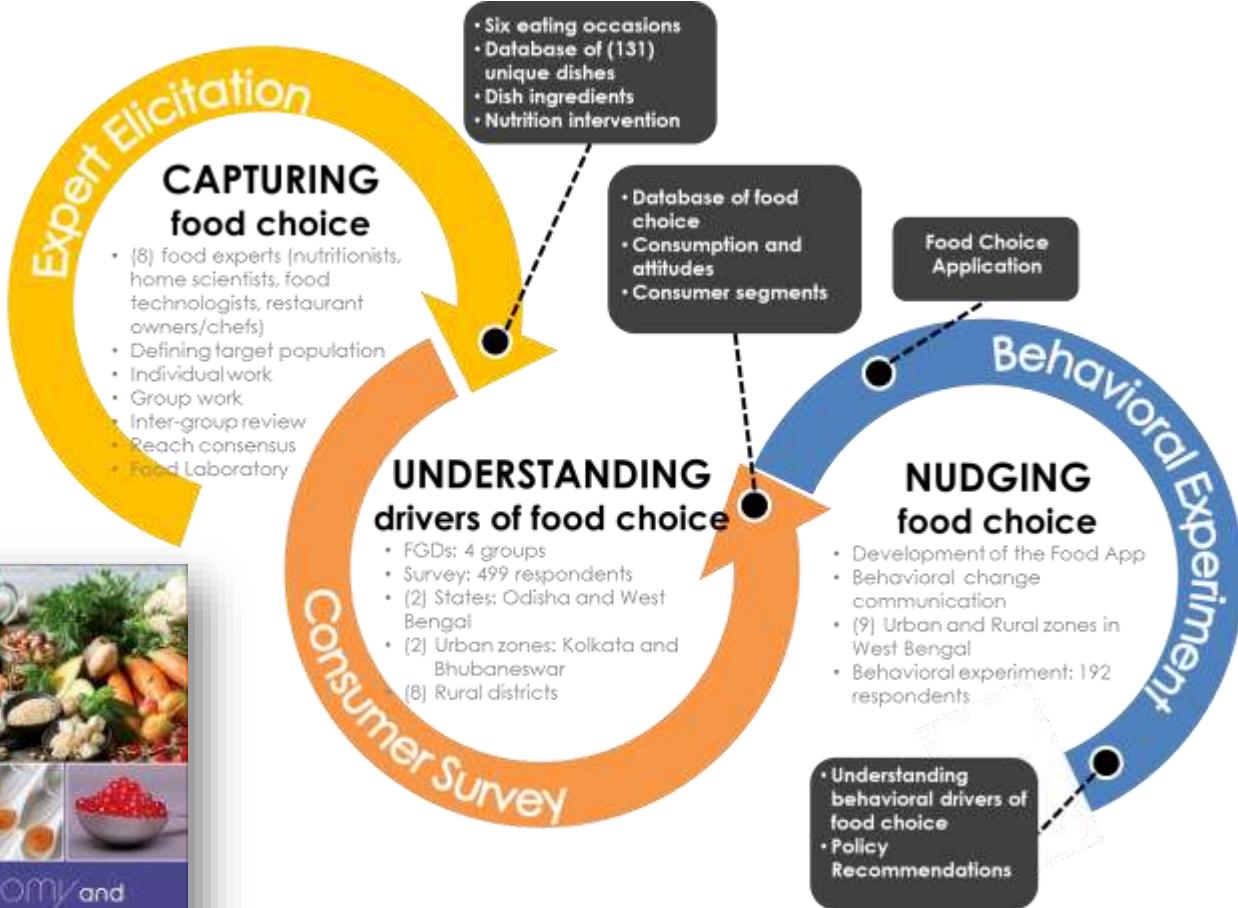


Gastronomy and
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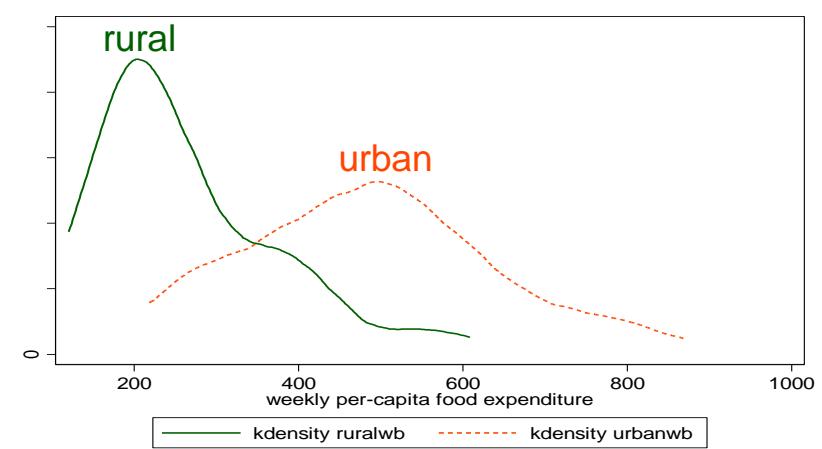
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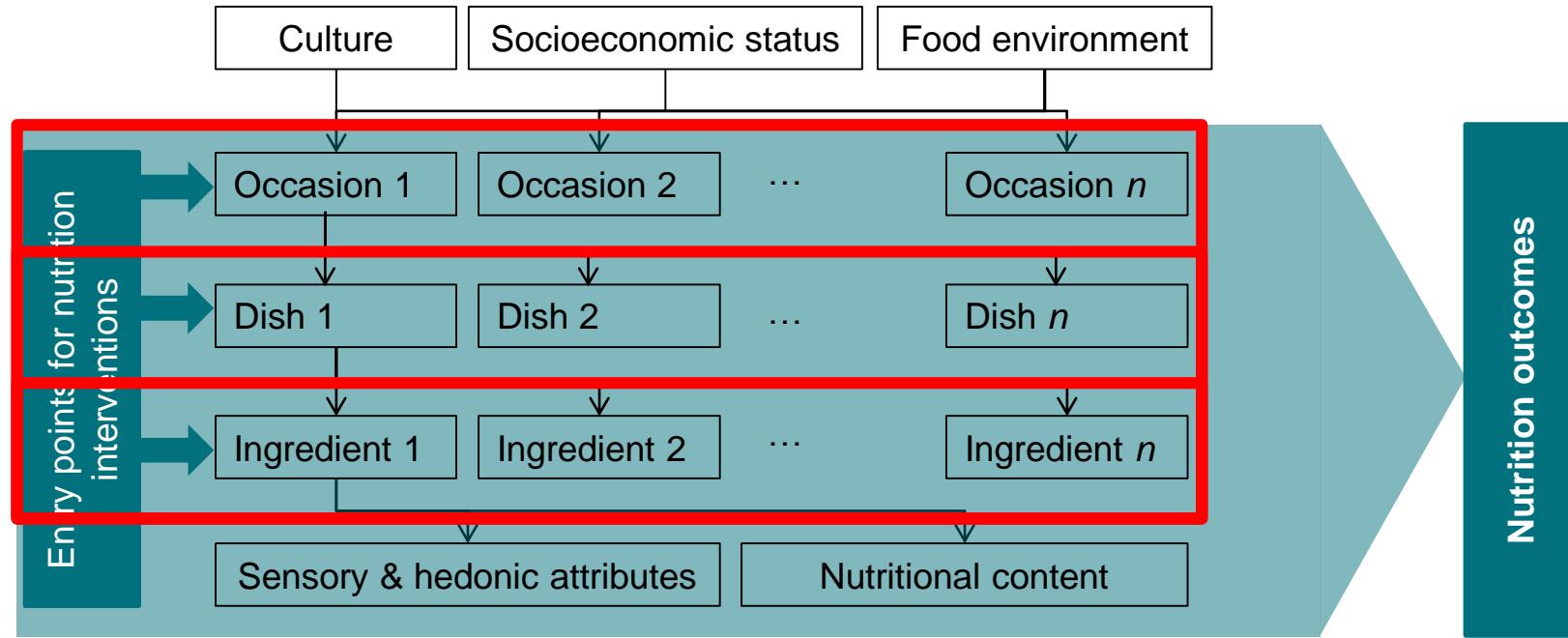
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Behavioral Experiment

- 177 households (both husband & wife)
- 9 urban & rural areas in West Bengal, 2018
- Low- & middle-income classes
- Two interventions (treatments):
 1. **Budget shock:** random food budget
 2. **Behavioral Change Communication (BCC)** at 3 levels (ingredients, dishes, occasions) based on local knowledge



Behavioral Change Communication (BCC)



Sources: Cuevas et al. (2017; 2021); Samaddar et al. (2020); Custodio et al. (2021)

Data & variables

- $n = 529$ (177 households \times 3 observations/household, i.e. husband, wife, consensus)
- Dependent variables:
 1. Planned **food expenditure shares** among food groups (starch, nonveg, pulses, dairy, veg, fruit, savings) (%)
 2. Planned per-capita **rice consumption** (kg)
 3. Planned household dietary diversity scores (**HDDS**) (# food groups)
 4. Planned total per-capita **calorie consumption**
 5. Planned calorie distribution among **macro-nutrients** (carbs, proteins, fat)
 6. Planned calorie distribution among **occasions** (breakfast, AM/PM snacks, lunch, dinner)
 7. Women's intrahousehold decision-making power (**WIDMP**) in diet budgeting based on HDDS (%) ($n = 155$)
- Independent variables:
 1. Location (Kolkata, North) & timing (weekend, morning)
 2. Treatment variables (**artificial per-capita budget constraint**, T₁, T₂, T₃)
 3. Self-reported hunger level at the time of the experiment
 4. Socio-economic variables (gender, education, employment, **income**, **real per-capita food budget**, involvement in food preparation, trust in nutrition labels, household size & composition)

Econometric models

Dependent variables:

- Multiple proportions (food expenditure shares, calorie distributions):
fractional regression: **fmlogit** command in Stata SE v14
- Continuous (per-capita rice consumption, HDDS, total per-capita calorie consumption):
OLS linear regression: **regress** command in Stata SE v14
- Single proportion (women's intra-household decision-making power, WIDMP):
fractional probit: **fracreg** command in Stata SE v14

Features:

- **Panel** dataset: standard errors clustered at household level (except WIDMP, $n = 155$)
- Critical significance levels: * $< 5\%$; ** $< 1\%$; *** $< 0.1\%$
- Variance inflation factors (VIFs) average **1.92** and vary between **1.12** and **4.93**
- Test of joint orthogonality of treatments suggest randomization was **acceptable**

Table 2: Econometric results of the nudging experiment

	Driver	Intermediate outcomes										Final outcomes									
		Food expenditure shares						Caloric distribution				Caloric distribution among occasions									
		WIDMP	Starch	Nonveg	Pulses	Dairy	Veg	Fruit	Savings	Rice/cap	HDDS	Cal/capita	Carbs	Protein	Fat	Breakfast	AM snack	Lunch	PM snack	Dinner	
Weekend		0.001 (0.013)	0.012 (0.016)	0.050* (0.017)	-0.007 (0.007)	0.002 (0.005)	-0.001 (0.012)	0.003 (0.003)	-0.060* (0.019)	-4.399 (6.331)	0.045 (0.091)	6.128 (59.367)	-0.014 (0.008)	0.002 (0.002)	0.012 (0.008)	-0.010 (0.010)	0.018* (0.008)	-0.009 (0.010)	-0.000 (0.012)	-0.000 (0.013)	0.001 (0.011)
Morning		-0.055 (0.040)	0.007 (0.014)	-0.018 (0.023)	0.007 (0.008)	-0.002 (0.006)	-0.002 (0.012)	-0.001 (0.003)	0.009 (0.021)	19.246** (6.836)	-0.165 (0.086)	-54.767 (55.360)	0.005 (0.009)	0.002 (0.002)	-0.007 (0.009)	0.016 (0.010)	-0.014 (0.010)	-0.007 (0.012)	0.009 (0.016)	-0.004 (0.011)	
Kolkata		-0.032 (0.052)	0.023 (0.021)	0.044 (0.029)	-0.016 (0.013)	0.019* (0.007)	0.002 (0.019)	-0.049 (0.003)	-37.728*** (7.818)	0.385** (0.122)	151.110 (100.615)	-0.010 (0.013)	-0.010 (0.003)	-0.020 (0.013)	-0.001 (0.012)	-0.025 (0.017)	0.034* (0.015)	0.039* (0.016)	-0.047** (0.016)		
North		-0.015 (0.022)	-0.011 (0.017)	-0.054 (0.032)	0.017 (0.010)	0.011 (0.009)	0.035 (0.018)	-0.010** (0.004)	0.013 (0.029)	18.353* (8.305)	0.011 (0.105)	-19.934 (69.454)	-0.025* (0.011)	0.015*** (0.003)	0.010 (0.011)	-0.023 (0.013)	0.067*** (0.014)	0.016* (0.017)	-0.061* (0.025)	0.001 (0.014)	
T1: Ingredient		-0.019 (0.025)	-0.007 (0.017)	-0.011 (0.026)	0.024* (0.010)	-0.017** (0.007)	-0.011 (0.016)	-0.010** (0.003)	0.032 (0.022)	0.021 (7.573)	-0.494*** (70.105)	-132.196 (0.011)	-0.026* (0.003)	0.016*** (0.003)	0.010 (0.010)	-0.013 (0.011)	0.075*** (0.015)	-0.004 (0.014)	-0.030* (0.017)	-0.028 (0.015)	
T2: Ingredient + dish		-0.015 (0.023)	-0.015 (0.017)	-0.000 (0.024)	0.002 (0.009)	-0.010* (0.005)	0.007 (0.015)	-0.008** (0.003)	0.024 (0.024)	-20.703** (6.864)	-0.333** (0.104)	-104.262 (70.711)	-0.010 (0.010)	0.006 (0.003)	0.004 (0.009)	0.004 (0.010)	0.049*** (0.014)	-0.015 (0.013)	-0.009 (0.015)	-0.030* (0.014)	
T3: Ingredient + dish + occasion		-0.010 (0.023)	0.021 (0.016)	-0.006 (0.024)	0.013 (0.009)	-0.012 (0.005)	-0.014 (0.015)	-0.012*** (0.009)	0.009 (0.022)	6.027 (7.471)	-0.581*** (0.114)	-64.492 (83.356)	-0.013 (0.011)	0.012*** (0.003)	0.001 (0.011)	-0.020 (0.011)	0.084*** (0.015)	-0.037** (0.013)	-0.018 (0.017)	-0.011 (0.013)	
Per capita budget constraint (in '00 INR)		0.001 (0.004)	0.188*** (0.016)	-0.032 (0.017)	0.030*** (0.009)	-0.006 (0.004)	0.036* (0.004)	-0.000 (0.002)	-0.215** (0.019)	-27.922*** (6.855)	-0.699*** (0.089)	-847.828*** (83.174)	0.028* (0.009)	-0.003 (0.002)	-0.026* (0.009)	0.024* (0.010)	0.002 (0.011)	-0.000* (0.012)	-0.000* (0.012)	-0.005 (0.012)	
Self-reported hunger level*		0.004* (0.122)*	-0.004* (0.124)*	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.049 (0.052)	-0.003*** (0.001)	-0.725 (0.588)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	
Husband	n.a.	0.045*** (0.010)	-0.017 (0.011)	0.021*** (0.005)	-0.003 (0.003)	-0.004 (0.009)	0.003 (0.002)	-0.045*** (0.011)	11.431** (3.645)	-0.062 (0.055)	167.181*** (36.096)	-0.001 (0.005)	0.000 (0.001)	0.000 (0.005)	0.003 (0.007)	-0.004 (0.006)	-0.004 (0.007)	-0.004 (0.007)	0.017* (0.006)	-0.011 (0.006)	
Wife	n.a.	-0.006 (0.008)	0.007 (0.011)	-0.012 (0.006)	0.002 (0.004)	-0.012 (0.002)	-0.012 (0.001)	0.000 (0.001)	-0.021 (0.001)	-6.271 (3.821)	-0.021 (0.005)	-8.594*** (2.821)	-0.004 (0.002)	0.006*** (0.005)	-0.002 (0.005)	0.020* (0.007)	-0.036*** (0.008)	0.016* (0.006)	-0.001 (0.006)		
Husband education (at least high school)		-0.026 (0.039)	-0.012 (0.012)	0.035 (0.019)	-0.001 (0.007)	0.000 (0.004)	-0.001 (0.003)	-0.001 (0.002)	-0.001 (0.001)	-74.218 (5.598)	-0.699*** (0.078)	-847.828*** (15.258)	0.028* (0.008)	-0.003 (0.008)	-0.026* (0.009)	0.024* (0.010)	0.002 (0.010)	-0.006 (0.012)	0.017 (0.010)		
Wife education (at least high school)		0.046 (0.031)	0.030*** (0.011)	-0.008 (0.017)	0.001 (0.004)	-0.004 (0.004)	-0.024* (0.011)	-0.005* (0.011)	0.011 (0.014)	-0.469 (5.598)	-0.096 (0.078)	-47391 (47.281)	0.008 (0.008)	-0.005** (0.008)	-0.002 (0.008)	-0.006 (0.008)	-0.015 (0.009)	0.008 (0.012)	-0.004 (0.010)	-0.005 (0.010)	
Husband is employed in agriculture		0.006 (0.018)	0.000 (0.017)	-0.039 (0.029)	0.005 (0.009)	0.004 (0.009)	0.004 (0.016)	-0.011 (0.006)	0.037 (0.032)	13.810 (8.058)	-0.109 (0.104)	-19.721 (71.524)	-0.009 (0.011)	-0.002 (0.010)	0.010 (0.012)	0.004 (0.014)	0.021* (0.010)	0.018 (0.012)	-0.048* (0.014)	0.004 (0.014)	
Wife is employed		-0.011 (0.009)	0.008 (0.018)	-0.010 (0.023)	0.003 (0.009)	0.003 (0.009)	0.006 (0.014)	0.030* (0.018)	0.001 (0.018)	-0.038* (6.705)	-23.273*** (6.705)	-48.502 (70.920)	-0.125* (0.012)	-0.011 (0.012)	0.003 (0.013)	0.008 (0.011)	0.015 (0.013)	-0.009 (0.013)	0.023 (0.020)		
Wife involved in all food preparation activities		0.141** (0.048)	0.009 (0.013)	0.001 (0.021)	-0.005 (0.007)	-0.003 (0.007)	-0.014 (0.002)	-0.004 (0.002)	0.015 (0.018)	4.811 (6.156)	-0.055 (0.087)	-59.206 (54.661)	0.013 (0.008)	-0.001 (0.002)	-0.011 (0.007)	-0.005 (0.009)	0.010 (0.010)	-0.011 (0.010)	0.020 (0.010)	-0.015 (0.010)	
Household has refrigerator		-0.029 (0.041)	-0.020 (0.015)	-0.009 (0.020)	-0.008 (0.008)	0.002 (0.004)	0.017 (0.013)	0.002 (0.003)	0.020 (0.018)	0.501 (6.067)	-0.084 (0.085)	-95.328 (73.866)	0.001 (0.009)	0.001 (0.002)	-0.002 (0.008)	0.004 (0.008)	0.012 (0.011)	0.004 (0.012)	-0.026* (0.012)	0.010 (0.012)	
Income per capita ('000 INR)		-0.021 (0.049)	-0.003 (0.002)	0.006 (0.003)	0.001 (0.001)	0.000 (0.000)	0.002 (0.002)	0.000 (0.002)	-0.006** (0.002)	-0.717 (0.867)	0.022 (0.013)	-6.951 (8.274)	-0.002 (0.001)	0.000 (0.001)	0.002 (0.001)	-0.002 (0.002)	0.001 (0.002)	0.003 (0.002)	-0.002 (0.001)	-0.001 (0.001)	
Weekly per capita food budget ('00 INR)		0.042 (0.126)	-0.052** (0.006)	0.006 (0.006)	-0.009** (0.003)	0.000 (0.001)	-0.014** (0.005)	0.000 (0.009)	0.069*** (2.463)	8.274*** (2.463)	0.137*** (0.039)	215.154*** (27.429)	-0.009** (0.003)	0.002 (0.001)	0.007 (0.003)	-0.008* (0.004)	0.004 (0.004)	-0.004 (0.004)	0.003 (0.005)		
Husband trusts nutrition labels		0.007 (0.014)	-0.000 (0.012)	-0.020 (0.018)	0.001 (0.008)	0.008* (0.003)	0.010 (0.011)	-0.003 (0.002)	0.004 (0.017)	-1.507 (5.266)	0.073 (0.090)	34.121 (61.215)	-0.013 (0.008)	0.005* (0.007)	0.008* (0.012)	-0.022* (0.009)	-0.005 (0.010)	0.010 (0.010)	0.003 (0.010)		
Wife trusts nutrition labels		0.059 (0.034)	-0.015 (0.012)	0.037 (0.020)	-0.005 (0.008)	0.013** (0.012)	0.003 (0.002)	0.002 (0.014)	-0.035* (5.784)	-2.138 (5.784)	0.278*** (0.081)	35.047 (61.017)	-0.001 (0.009)	0.001 (0.002)	0.011 (0.010)	0.018 (0.012)	-0.009 (0.009)	-0.007 (0.012)	-0.006 (0.011)		
Household size		0.207* (0.104)	-0.010* (0.004)	0.003 (0.005)	-0.002 (0.002)	-0.004* (0.004)	-0.002 (0.001)	0.017** (0.004)	1.764 (1.622)	-0.038 (0.025)	-74.982*** (18.359)	-0.003 (0.002)	0.001 (0.001)	0.002 (0.003)	-0.002 (0.002)	0.006* (0.003)	0.005* (0.004)	-0.004 (0.003)	-0.005 (0.003)		
Household has children <5y		-0.028 (0.014)	-0.020 (0.013)	0.014 (0.021)	0.008 (0.007)	0.007 (0.012)	-0.019 (0.019)	0.001 (0.019)	0.009 (0.019)	6.816 (6.315)	-0.040 (0.084)	-45.719 (55.525)	-0.004 (0.008)	0.002 (0.002)	0.002 (0.008)	0.008 (0.010)	-0.010 (0.010)	0.002 (0.013)	-0.005 (0.009)	-0.005 (0.009)	
Household has seniors >65y		-0.009 (0.015)	0.015 (0.019)	-0.031 (0.008)	0.013 (0.005)	0.009 (0.012)	0.020 (0.003)	0.003 (0.022)	-0.028 (5.923)	-3.426 (0.959)	0.122 (60.475)	10.877 (60.099)	-0.008 (0.009)	0.001 (0.002)	0.007 (0.009)	-0.012 (0.012)	-0.002 (0.012)	0.005 (0.012)	-0.006 (0.014)		
Constant									67.774*** (19.286)	3.788* (0.272)	1374.634*** (170.571)										
Sample size		155	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529	529		

3 KEY RESULTS

1. Treatment effects

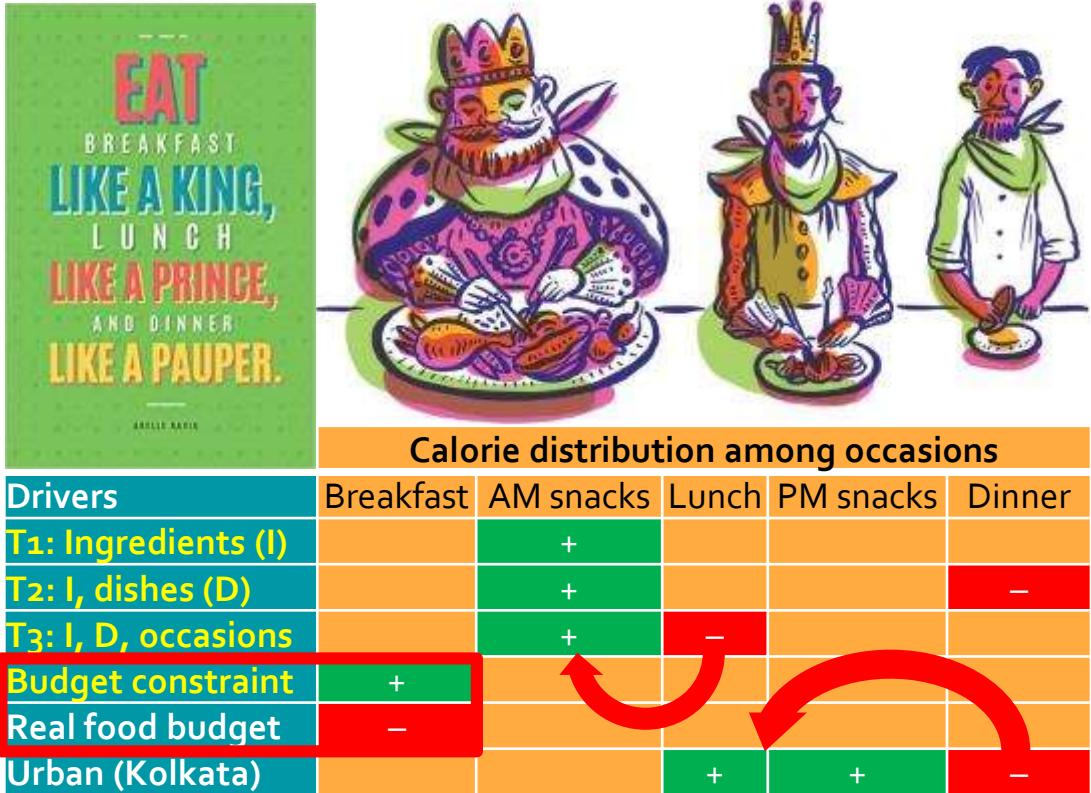
Conclusions: Indian diets, across states and income groups, are unhealthy. Indians also consume excess amounts of cereals and not enough proteins, fruits, and vegetables. Importantly, unlike many countries, excess consumption

T1: Ingredients		+	-	-	-	-	-	+
T2: Ingredients, dishes			-	-	-	-	-	+
T3: Ingredients, dishes, occasions				-	-	-	-	+
Artificial budget constraint (shock)	+		+	+	-	-	+	-
Real food budget	-		-	-		+	-	+
Household income		+						
Weekend		+						
Urban (Kolkata)			+			+		-

Notes: Nonveg = chicken, mutton, pork, beef, fish, egg, seafood, etc. The + and - signs indicate significance at <5% level in fmlogit model.

- BCCs (i) trigger some replacement of animal by plant proteins & (ii) carbs by proteins; however, (iii) at the expense of fruits & dietary diversity
- Budget constraints (i) boost expenditures on starch, pulses & vegetables; (ii) reduce dietary diversity; & (iii) increase dietary carbs & reduce dietary fat

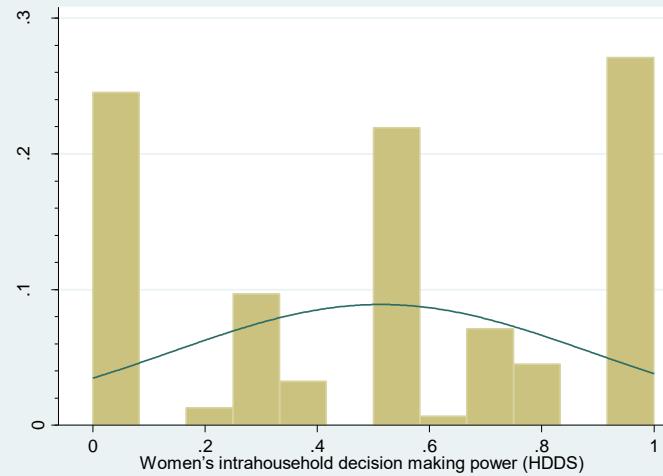
2. Did T3 successfully postpone planned calorie intake?



- Yes, but T₃ only shifts calories from lunch towards **AM snacks**
- Urbanization shifts calories from **dinner to lunch & PM snacks**
- Budget constraints prioritize calories from **breakfast**

3. Gender effects

	WIDMP	Food expenditure shares					Cal/capita	Calorie shares			
Drivers		starch	nonveg	pulses	dairy	veg	fruit		carbs	protein	fat
Husband			+		+			+			
Wife				-				-		+	
Wife involved	+										
Household size	+	-			-			-			



- Men tend to prioritize **starchy dishes & pulses** & plan higher per-capita **calorie** consumption levels, while women tend to prioritize **proteins**
- Women are more empowered in household diet planning when they are **involved** in food preparation & the **larger** the household
- Larger households tend to spend less on starchy dishes & dairy & plan lower per-capita calories

CONCLUSION



- Nudging not that straightforward
- BCCs successfully triggered some **substitution** of starch & animal for plant proteins; however, at the expense of **dietary diversity**
- **Trade-off** between substitution & diversification
- More research is warranted on the optimal messaging in BCCs that can nudge consumers towards **diversified planetary health diets**

The private sector spends billions of dollars on influencing consumers to buy certain foods and influencing policymakers to shape the regulatory infrastructure. The public sector spends very little on understanding why people consume the foods they do and on why decision makers take the decisions they do. [...] we are in desperate need of forming two key alliances of researchers, one for doing consumer insight research on food choices and the other for doing research on the political economy of food choices.

Lawrence Haddad (*Food Policy*, 2020)

THANK YOU

Jhoanne Ynion, Marie Claire Custodio, Arindam Samaddar, Rochie Cuevas, Cecilia Acuin, IRRI
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