

WDDP-II RESULTS: DATASETS DESCRIPTION & PERFORMANCE OF 2 CANDIDATE INDICATORS

Reaching Consensus on a Global Dietary Diversity Indicator for Women,
Washington, DC, July 15–16, 2014

Yves Martin-Prével on behalf of the WDDP-II core group
July 16, 2014



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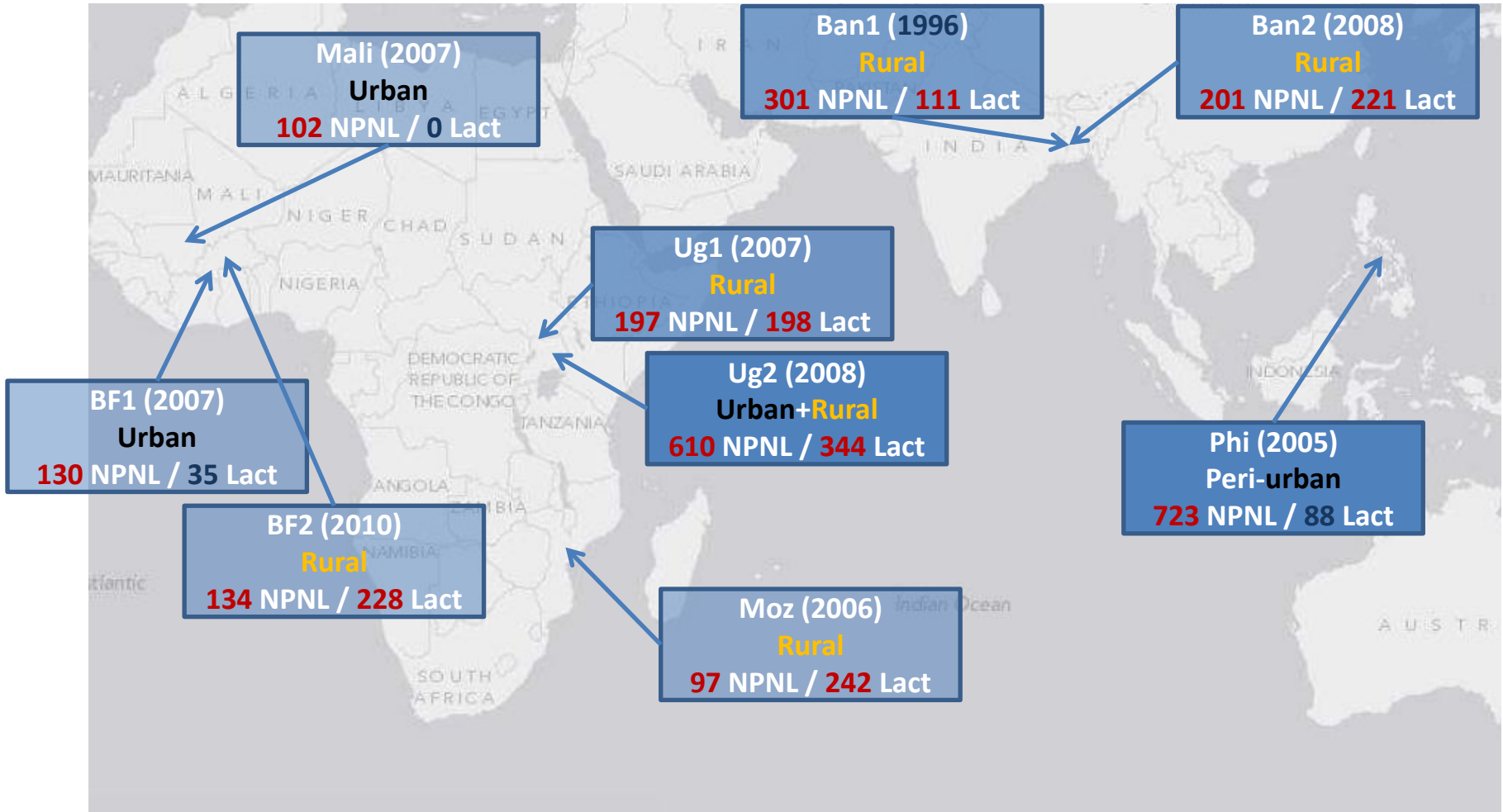
Outline

- Brief datasets description
- Characteristics of women's food consumption
- Performance of 2 candidate food group indicators (FGI) at the individual level
 - Correlation between FGIs and Mean Probability of Adequacy (MPA)
 - Receiver Operating Characteristic Curve (ROC) analysis
 - Sensitivity/Specificity (selection of best FGI and MPA cutoffs)
- Relationships between characteristics of the diet and dichotomous FGIs at the population level
- Conclusion

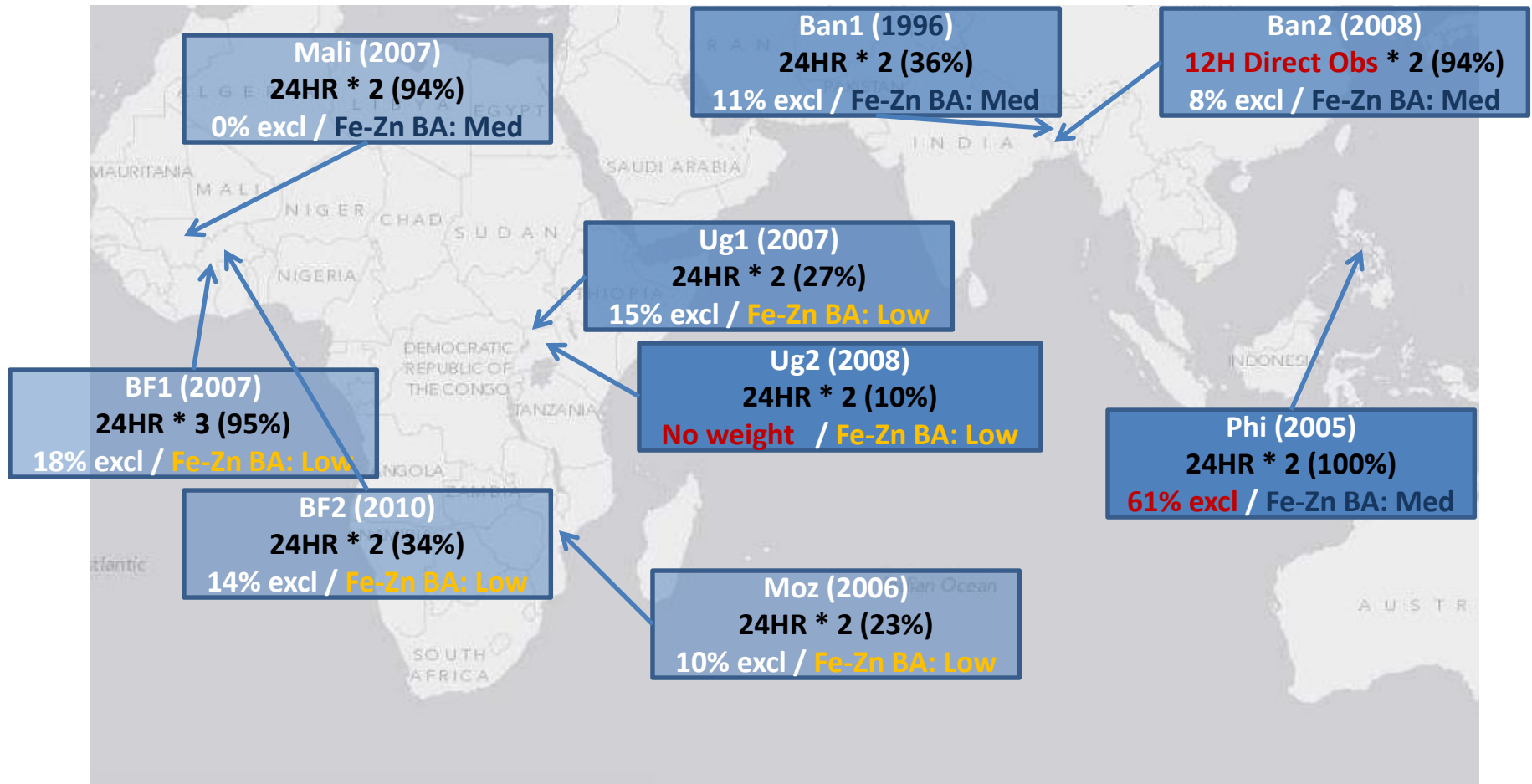
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The 9 WDDP-II data sets



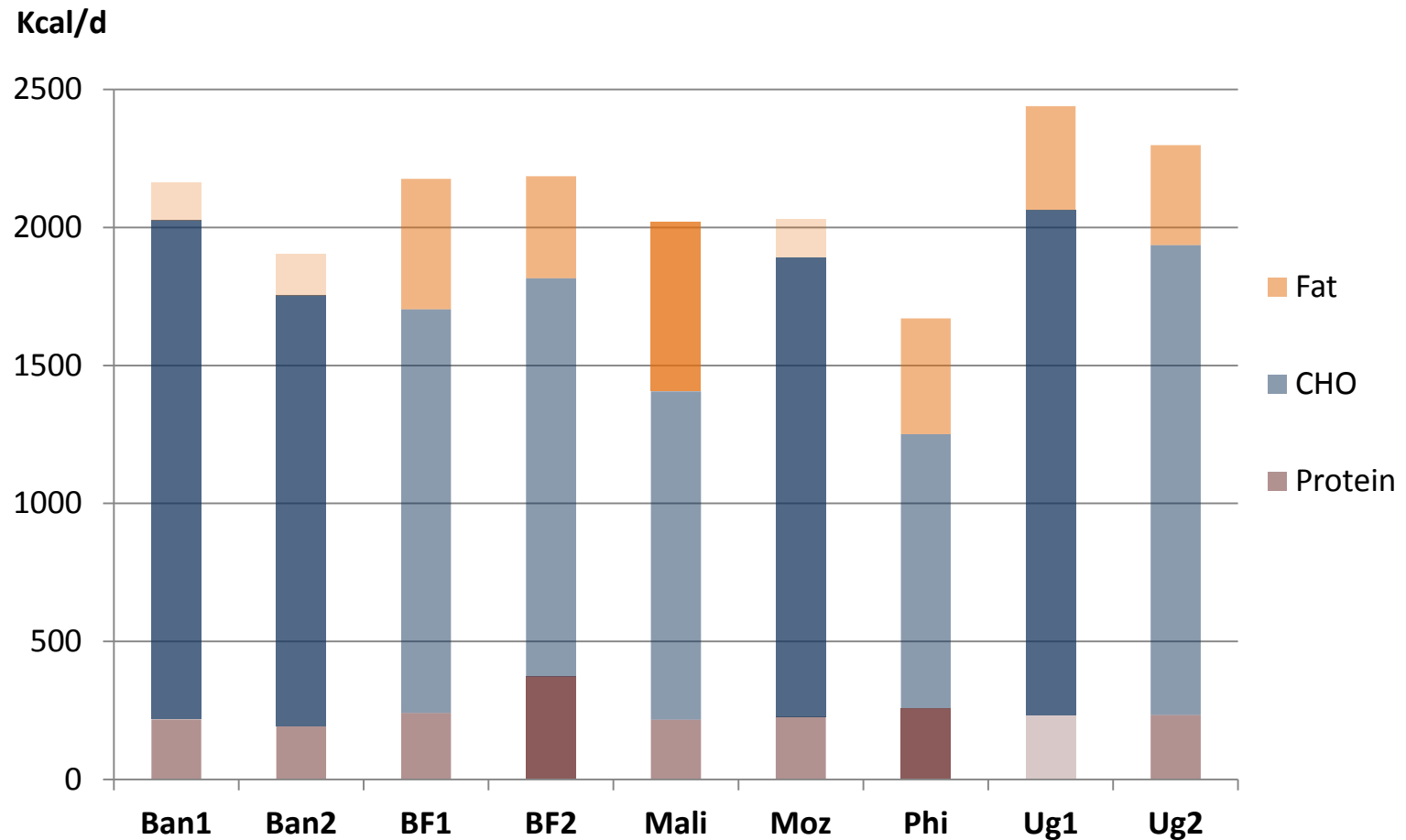
Methods of dietary data collection



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Consumption of energy and macronutrients



PAAs and MPA across 11 micronutrients

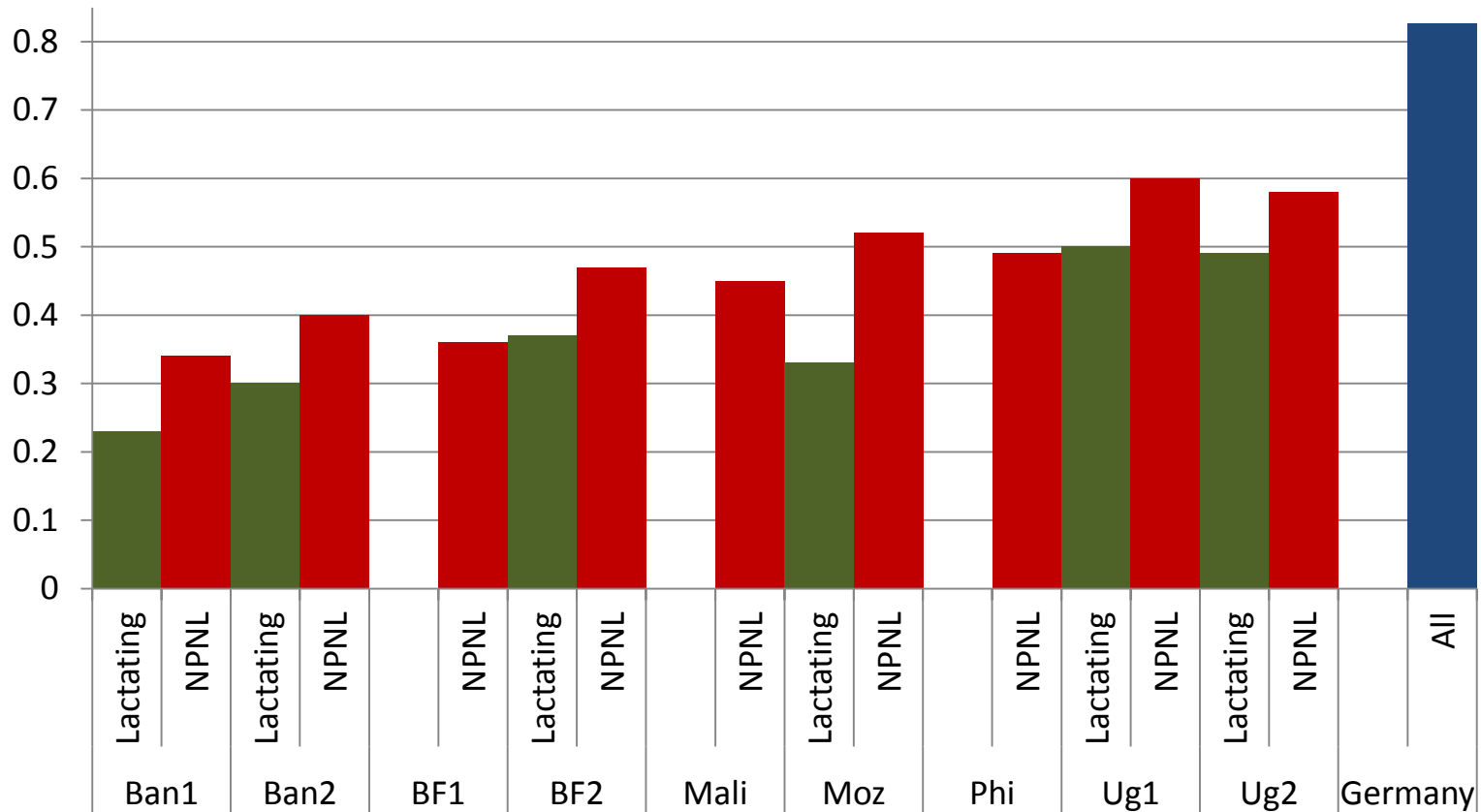
among Non Pregnant Non Lactating (NPNL) women

Dataset	MPA	PAAs										
		Thia	Ribo	Niac	VitB6	Folat	B12	VitC	VitA	Calc	Iron	Zinc
Ban1	0.34	0.09	0.15	0.30	0.82	0.02	0.20	0.52	0.53	0.04	0.10	0.93
Ban2	0.40	0.62	0.01	1.00	1.00	0.00	0.01	0.74	0.38	0.00	0.09	0.60
BF1	0.36	0.45	0.11	0.19	0.64	0.15	0.08	0.66	0.73	0.03	0.16	0.77
BF2	0.47	0.61	0.67	0.79	0.59	0.36	0.03	0.33	0.32	0.18	0.37	0.95
Mali	0.45	0.60	0.28	0.31	0.67	0.00	0.17	0.88	0.50	0.04	0.53	0.96
Moz	0.52	0.68	0.45	0.49	0.90	0.45	0.23	0.90	0.86	0.01	0.01	0.76
Phi1	0.49	0.29	0.23	0.89	0.74	0.71	0.84	0.22	0.60	0.01	0.23	0.60
Ug1	0.60	0.91	0.50	0.83	0.99	0.53	0.21	0.98	0.82	0.05	0.04	0.76
Ug2	0.58	0.83	0.65	0.76	0.89	0.76	0.04	0.87	0.85	0.06	0.07	0.61
Color code PAAs:		> 0.75		0.5 – 0.75		0.25 – 0.50		< 0.25				

Datasets **in bold** used medium bio-availability for Fe and Zn (not in bold: low bio-availability)

MPA across 11 micronutrients among NPNL and lactating women

MPA



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Two candidate FGIs (reminder)

FGI-9	FGI-10
1 All starchy staples	1 All starchy staples
2 All legumes and nuts	2 Beans and peas
	3 Nuts and seeds
3 All dairy	4 All dairy
4 Organ meat	5 Flesh foods (including organ meat and miscellaneous small animal protein)
5 Flesh foods and miscell. small animal protein	
6 Eggs	6 Eggs
7 Vitamin A-rich dark green leafy vegetables	7 Vitamin A-rich dark green leafy vegetables
8 Other vitamin A-rich vegetables and fruits	8 Other vitamin A-rich vegetables and fruits
	9 Other vegetables
9 Other fruits and vegetables	10 Other fruits

NB: The remaining of this presentation will consider only 'restricted' indicators (i.e. minimum 15g consumption for a group to count in the score) referred to as **FGI-9R** and **FGI-10R**

% consumption of each group (All women)

FGI-9R		Ban1	Ban2	BF1	BF2	Mali	Moz	Phi	Ug1	Ug2
1	All starchy staples	100	100	100	100	100	100	100	99	95
2	All legumes and nuts	33	38	61	71	39	56	45	78	85
3	All dairy	18	11	17	2	47	0	29	16	23
4	Organ meat	0	0	0	0	0	0	13	0	0
5	Flesh foods and miscell.	57	39	73	15	95	41	98	41	30
6	Eggs	3	12	1	0	7	6	32	6	6
7	Vitamin A-rich DGLV	49	44	51	48	28	34	25	27	34
8	Other vitamin A-rich F&V	16	20	33	6	25	77	22	47	66
9	Other fruits and vegetables	82	92	93	44	100	53	65	96	68
Mean FGI score		3.6	3.6	4.3	2.9	4.4	3.7	4.3	4.1	4.1
(SD)		(1.1)	(1.1)	(1.1)	(0.8)	(1.1)	(0.8)	(1.6)	(0.9)	(1.2)
% of women cons. ≥ 5 groups		20%	18%	43%	1%	42%	15%	41%	31%	36%
(N)		(82)	(78)	(76)	(6)	(43)	(59)	(351)	(141)	(339)

% consumption of each group (All women)

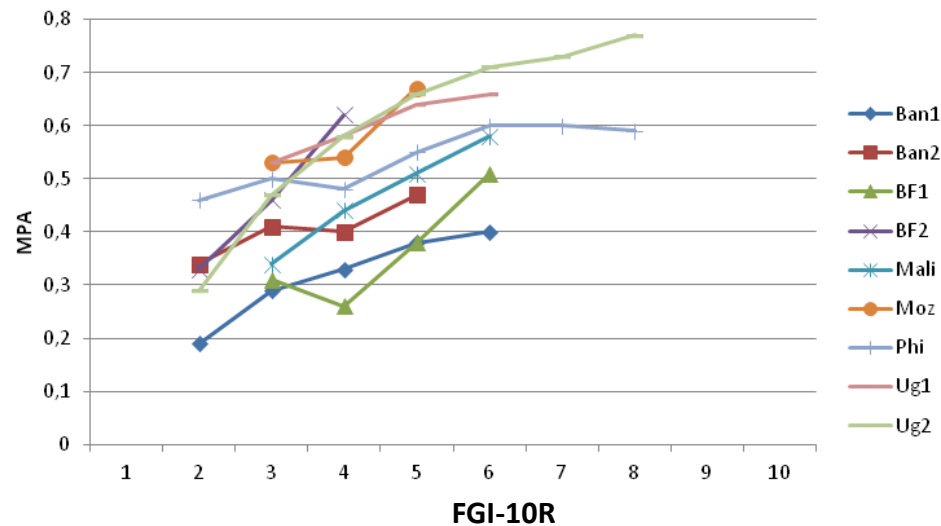
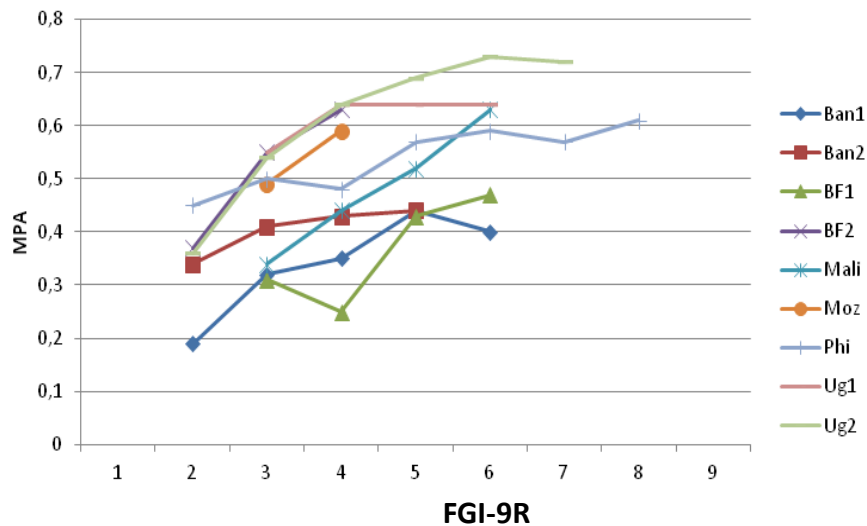
FGI-10R		Ban1	Ban2	BF1	BF2	Mali	Moz	Phi	Ug1	Ug2
1	All starchy staples	100	100	100	100	100	100	100	99	95
2	Beans and peas	20	36	27	29	4	51	44	39	69
3	Nuts and seeds	17	2	41	55	36	12	3	56	40
4	All dairy	18	11	17	2	47	0	29	16	23
5	All Flesh foods and miscell.	57	39	73	15	95	41	98	41	30
6	Eggs	3	12	1	0	7	6	32	6	6
7	Vitamin A-rich DGLV	49	44	51	48	28	34	25	27	34
8	Other vitamin A-rich F&V	16	20	33	6	25	77	22	47	66
9	Other vegetables	74	89	92	43	100	45	60	85	41
10	Other fruits	26	16	7	2	7	19	19	63	57
Mean FGI score		3.8	3.7	4.4	3.0	4.5	3.9	4.3	4.8	4.6
(SD)		(1.2)	(1.1)	(1.2)	(0.9)	(1.1)	(1.1)	(1.6)	(1.2)	(1.4)
% of women cons. ≥ 5 groups		26%	23%	47%	5%	44%	24%	41%	58%	52%
(N)		(109)	(96)	(84)	(21)	(45)	(92)	(350)	(206)	(494)

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Correlations between FGIs and MPA (NPNL Women)

NB: datapoints with fewer than 10 women are not presented in the graphs



	NC	C
Ban1	0.508 ***	0.451 ***
Ban2	0.341 ***	0.323 ***
BF1	0.414 ***	0.379 ***
BF2	0.459 ***	0.403 ***
Mali	0.473 ***	0.491 ***
Moz	0.420 ***	0.259 **
Phi	0.263 ***	0.246 ***
Ug1	0.268 ***	0.317 ***
Ug2	0.490 ***	0.285 ***

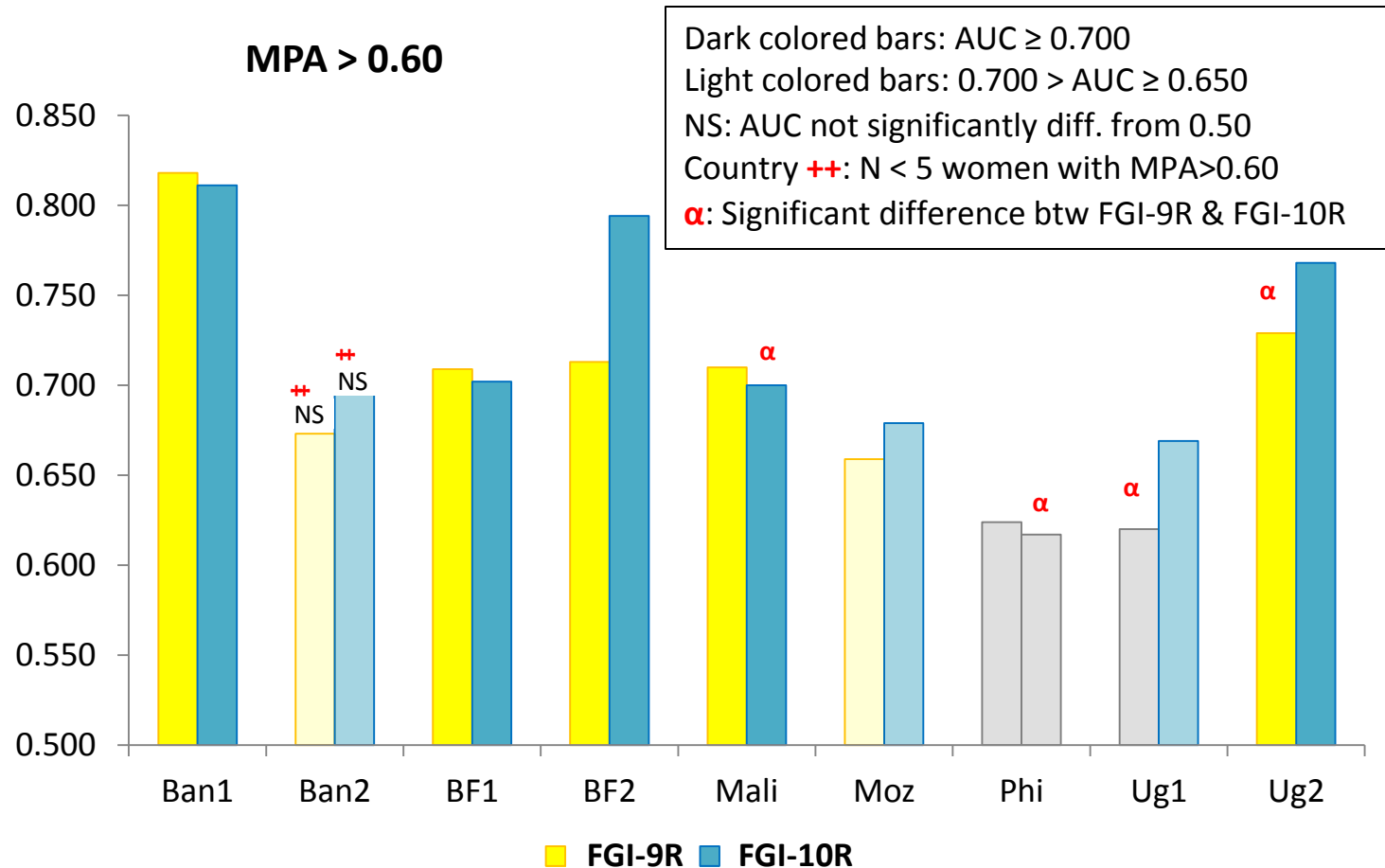
	NC	C
Ban1	0.502 ***	0.444 ***
Ban2	0.361 ***	0.325 ***
BF1	0.436 ***	0.393 ***
BF2	0.554 ***	0.459 ***
Mali	0.449 ***	0.475 ***
Moz	0.415 ***	0.308 **
Phi	0.254 ***	0.234 ***
Ug1	0.309 ***	0.289 ***
Ug2	0.558 ***	0.308 ***

NC / C: Not Controlled / Controlled for energy

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AUC values for the 2 candidate FGI-Rs



AUC values for the 2 candidate FGI-Rs

MPA > 0.60				
	FGI-9R	FGI-10R	Difference (FGI-10R - FGI-9R)	P-value
Ban1	0.818	0.811	-0.007	0.701
Ban2	0.673	0.695	0.022	0.673
BF1	0.709	0.702	-0.007	0.730
BF2	0.743	0.794	0.051	0.588
Mali	0.710	0.700	-0.010	0.012
Moz	0.636	0.680	0.044	0.028
Phi	0.624	0.617	-0.007	0.048
Ug1	0.620	0.669	0.049	0.261
Ug2	0.729	0.768	0.039	0.000

Color code: AUC<0.650 0.650≤AUC<0.700 0.700≤AUC<0.750 0.750<AUC≤0.800 0.800≤AUC P<0.05

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Selection of « best cutoff »

(example: FGI-9R dataset:Ban1)

N ^a	Food group cutoffs	Sensitivity	Specificity	Positive predictive value	Proportion of false positives	Proportion of false negatives	Total proportion misclassified
MPA > 0.50							
301	≥1	100	0	13.6	86.4	0	86.4
299	≥2	100	0.8	13.7	85.7	0	85.7
252	≥3	100	18.8	16.3	70.1	0	70.1
161	≥4	90.2	52.3	23	41.2	1.3	42.5
63	≥5	53.7	84.2	34.9	13.6	6.3	19.9
11	≥6	7.3	96.9	27.3	2.7	12.6	15.3
1	≥7	0	99.6	0	0.3	13.6	14
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-
MPA > 0.60							
301	≥1	100	0	6.3	93.7	0	93.7
299	≥2	100	0.7	6.4	93	0	93
252	≥3	100	17.4	7.5	77.4	0	77.4
161	≥4	94.7	49.3	11.2	47.5	0.3	47.8
63	≥5	68.4	82.3	20.6	16.6	2	18.6
11	≥6	15.8	97.2	27.3	2.7	5.3	8
1	≥7	0	99.6	0	0.3	6.3	6.6
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-
MPA > 0.70							
301	≥1	100	0	3.7	96.3	0	96.3
299	≥2	100	0.7	3.7	95.7	0	95.7
252	≥3	100	16.9	4.4	80.1	0	80.1
161	≥4	90.9	47.9	6.2	50.2	0.3	50.5
63	≥5	63.6	80.7	11.1	18.6	1.3	19.9
11	≥6	27.3	97.2	27.3	2.7	2.7	5.3
1	≥7	0	99.7	0	0.3	3.7	4
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-

^a Nb of women at or above the FG cutoff

Selection of « best cutoff »

(example: FGI-9R dataset:Ban1)

N ^a	Food group cutoffs	Sensitivity	Specificity	Positive predictive value	Proportion of false positives	Proportion of false negatives	Total proportion misclassified
MPA > 0.50							
301	≥1	100	0	13.6	86.4	0	86.4
299	≥2	100	0.8	13.7	85.7	0	85.7
252	≥3	100	18.8	16.3	70.1	0	70.1
161	≥4	90.2	52.3	23	41.2	1.3	42.5
63	≥5	53.7	84.2	34.9	13.6	6.3	19.9
11	≥6	7.3	96.9	27.3	2.7	12.6	15.3
1	≥7	0	99.6	0	0.3	13.6	14
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-
MPA > 0.60							
301	≥1	0	0	6.3	93.7	0	96.3
299	≥2	0	0.7	6.4	93	0	95.7
252	≥3	100	17.4	7.5	77.4	0	77.4
161	≥4	94.7	49.3	11.2	47.5	0.3	47.8
63	≥5	68.4	82.3	20.6	15.6	2	18.6
11	≥6	15.8	97.2	27.3	2.7	5.3	8
1	≥7	0	99.6	0	0	0	0
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-
MPA > 0.70							
301	≥1	100	0	3.7	96.3	0	96.3
299	≥2	100	0.7	3.7	95.7	0	95.7
252	≥3	100	16.9	4.4	80.1	0	80.1
161	≥4	90.9	47.9	6.2	50.2	0.3	50.5
63	≥5	63.6	80.7	11.1	18.6	1.3	19.9
11	≥6	27.3	97.2	27.3	2.7	2.7	5.3
1	≥7	0	99.7	0	0.3	3.7	4
0	≥8	-	-	-	-	-	-
0	≥9	-	-	-	-	-	-

Italic font:
Nb of women > 10

Bold font:
misclassified < 30%

Green: $Sp \geq 0.60 + Se \geq 0.60$
Orange: $Sp \geq 0.60 + Se \geq 0.50$
Yellow: $Sp \geq 0.50 + Se \geq 0.60$

^a Nb of women at or above the FG cutoff

Selection of « best cutoff »

Results for FGI-9R at MPA > 0.60

Range of values over all datasets

Food group cutoffs	Sensitivity	Specificity	Total proportion of misclassified	Datasets with "Best" cutoff					
≥ 1	100 - 100	0 - 0	43.1 - 98						
≥ 2	100 - 100	0 - 7.5	43.1 - 96.5						
≥ 3	90.2 - 100	2.5 - 49.5	38.1 - 83.8						
≥ 4	41.5 - 100	22.2 - 86	27.6 - 61.8	<i>Moz (39)</i>	<i>Ug2 (31)</i>				
≥ 5	0 - 68.4	59.6 - 98.9	18.6 - 45.7	Ban1 (19)	BF1 (40)	Mali (35)	Phi (37)	Ug2 (37)	
≥ 6	0 - 37.5	81.5 - 98.4	6 - 54.3						
≥ 7	0 - 14.5	91.8 - 99.6	2.5 - 53.1						

Bold font indicates rate of misclassification ≤ 30%; *Italic font indicates ≥ 10 women reaching the MPA level;*

Green highlighting indicates both sensitivity and specificity ≥ 60%;

Orange highlighting indicates specificity ≥ 60% and sensitivity < 60% but still ≥ 50%;

Yellow highlighting indicates sensitivity ≥ 60% and specificity < 60% but still ≥ 50%;

Selection of « best cutoff »

Results for FGI-10R at MPA > 0.60

Range of values over all datasets

Food group cutoffs	Sensitivity	Specificity	Total proportion of misclassified	Datasets with "Best" cutoff
≥ 1	100 - 100	0 - 0	43.1 - 98	
≥ 2	100 - 100	0 - 7.5	43.1 - 96.5	
≥ 3	91.1 - 100	2.5 - 46.2	38.8 - 83.1	
≥ 4	63.4 - 100	21.2 - 80.6	24.6 - 62.3	BF2 (25)
≥ 5	14.6 - 78.9	55.3 - 97.8	23.9 - 43.8	Ban1 (24) <i>Mali (37)</i> Phi (38) <i>Ug1 (36)</i> <i>Ug2 (30)</i>
≥ 6	0 - 50	81.1 - 98.2	8 - 45.2	BF1 (21)
≥ 7	0 - 17.7	90.5 - 100	3.5 - 54.3	

Bold font indicates rate of misclassification ≤ 30%; *Italic font indicates ≥ 10 women reaching the MPA level;*

Green highlighting indicates both sensitivity and specificity ≥ 60%;

Orange highlighting indicates specificity ≥ 60% and sensitivity < 60% but still ≥ 50%;

Yellow highlighting indicates sensitivity ≥ 60% and specificity < 60% but still ≥ 50%;

Se/Sp results across all datasets for the chosen cutoffs (FGI-R ≥ 5 and MPA >0.60)

FGI-9R	N ^a	Se	Sp	PPV	% of FP	% of FN	Total proportion misclassified
Ban1	63	68,4	82,1	20,6	16,7	2	18,7
Ban2	37	0	81,2	0	18,4	2	20,4
BF1	56	62,5	59,6	17,9	35,4	4,6	40
BF2	2	2,4	98,9	50	0,7	29,9	30,6
Mali	43	66,7	64,2	32,6	28,4	6,9	35,3
Moz	9	14,3	95,1	66,7	2,9	35	37,9
Phi	307	58,1	65,7	46,9	22,5	14,4	36,9
Ug1	62	37,5	76,5	67,7	10,2	35,5	45,7
Ug2	226	49	78,7	75,2	9,2	29	38,2

FGI-10R	N ^a	Se	Sp	PPV	% of FP	% of FN	Total proportion misclassified
Ban1	84	78,9	75,4	17,9	23,1	1,3	24,4
Ban2	46	25	77,2	2,2	22,4	1,5	23,9
BF1	61	62,5	55,3	16,4	39,2	4,6	43,8
BF2	8	14,6	97,8	75	1,5	26,1	27,6
Mali	45	66,7	61,7	31,1	30,4	6,9	37,3
Moz	18	35,7	94,5	83,3	3,1	27,8	30,9
Phi	308	56,5	64,6	45,5	23,2	14,9	38,2
Ug1	108	67	61,2	69,4	16,8	18,8	35,5
Ug2	317	69,5	71,1	76	12,5	17,4	29,8

^a Nb of women at or above the FG cutoff

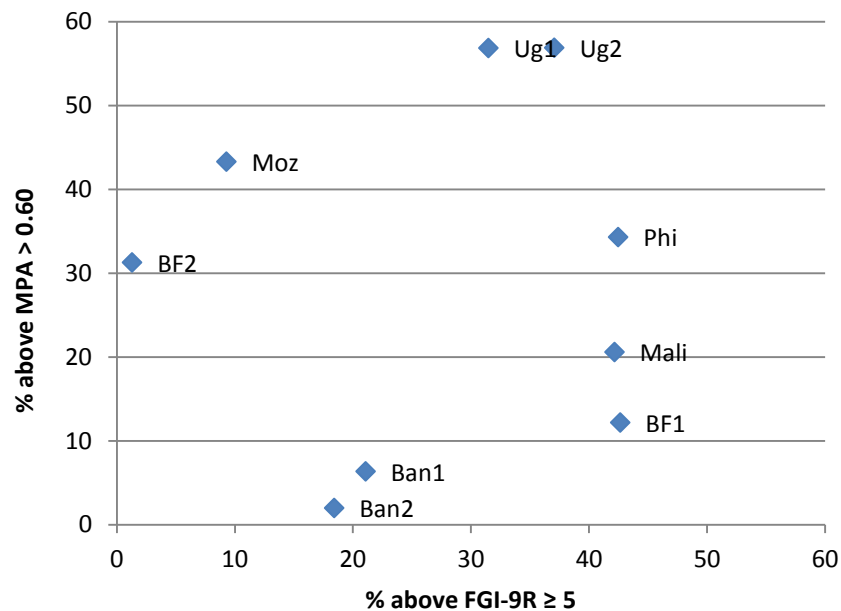
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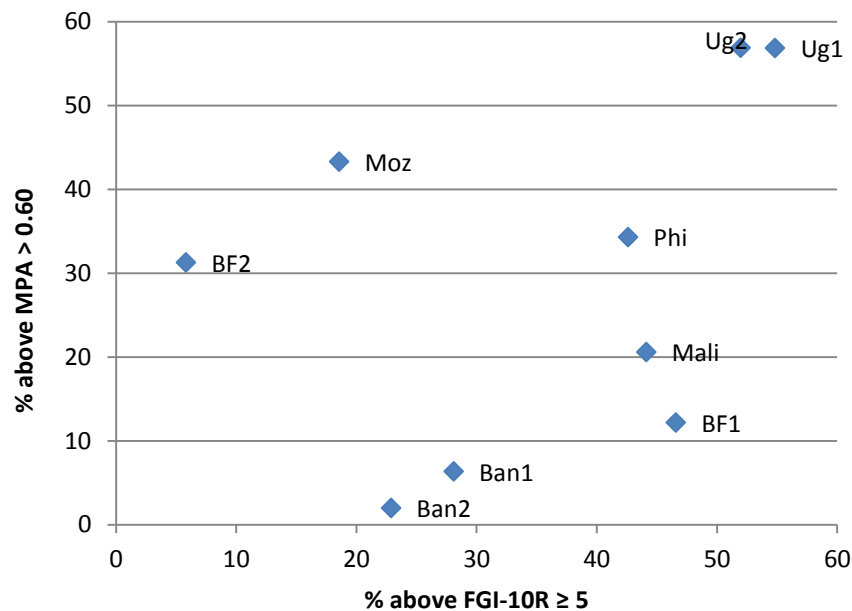
Prevalence matching (NPNL women)

(% women with FGI-R ≥ 5 vs % women with MPA > 0.60)

FGI-9R

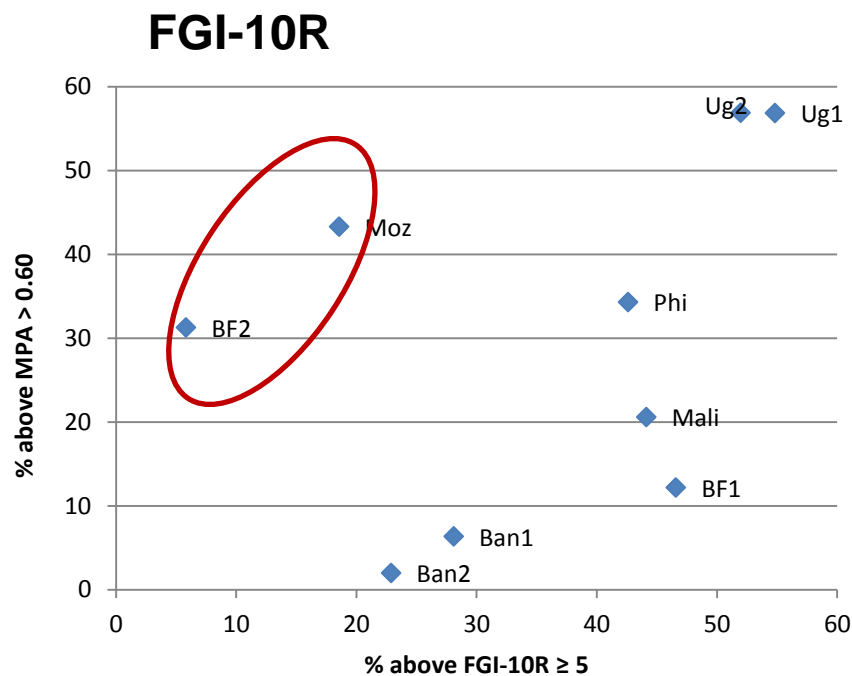
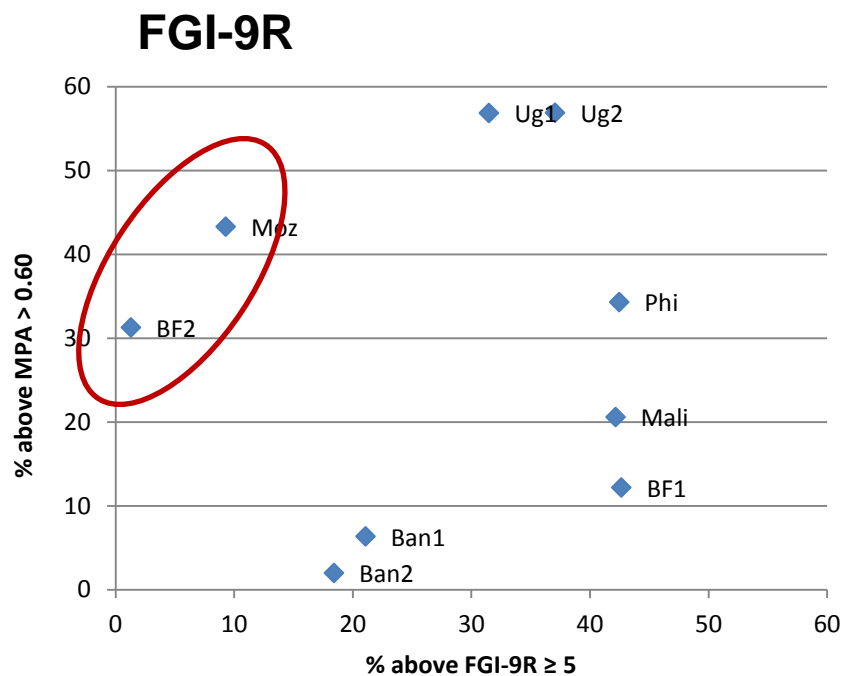


FGI-10R



Prevalence matching (NPNL women)

(% women with FGI-R ≥ 5 vs % women with MPA > 0.60)

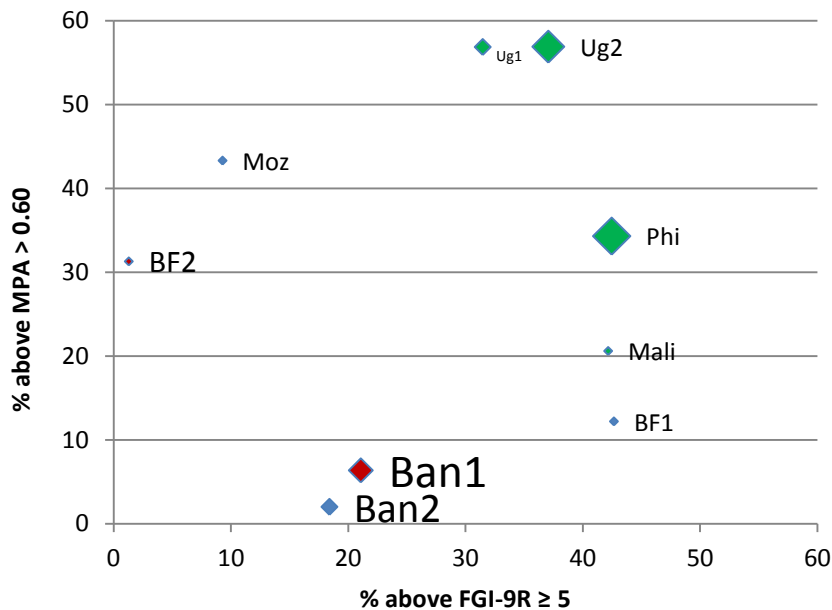


Spearman rank correlation				
Coeff.	p-value		Coeff.	p-value
0,03	0,93	All datasets (n=9)	0,36	0,43
0,4	0,29	Without outliers (n=7)	0,82	0,02

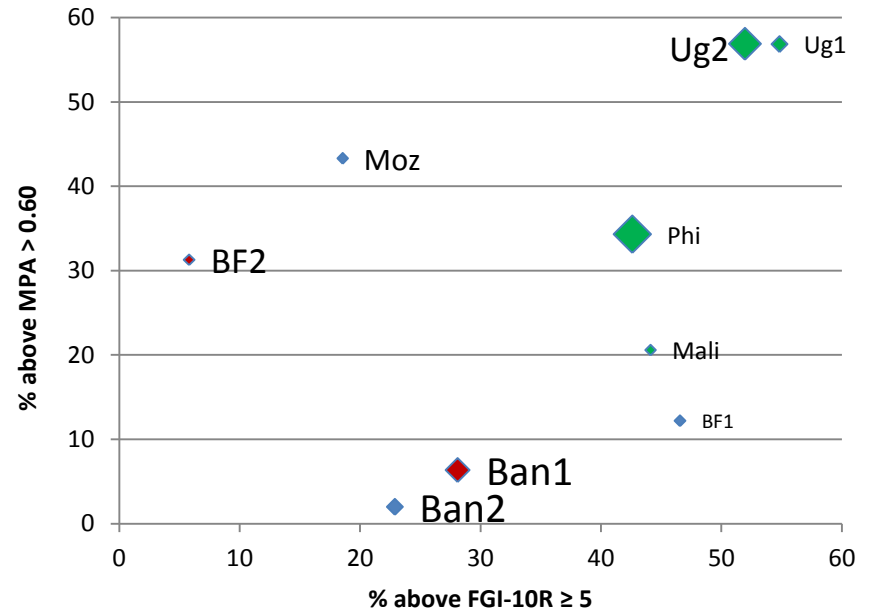
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FGI-9R



FGI-10R

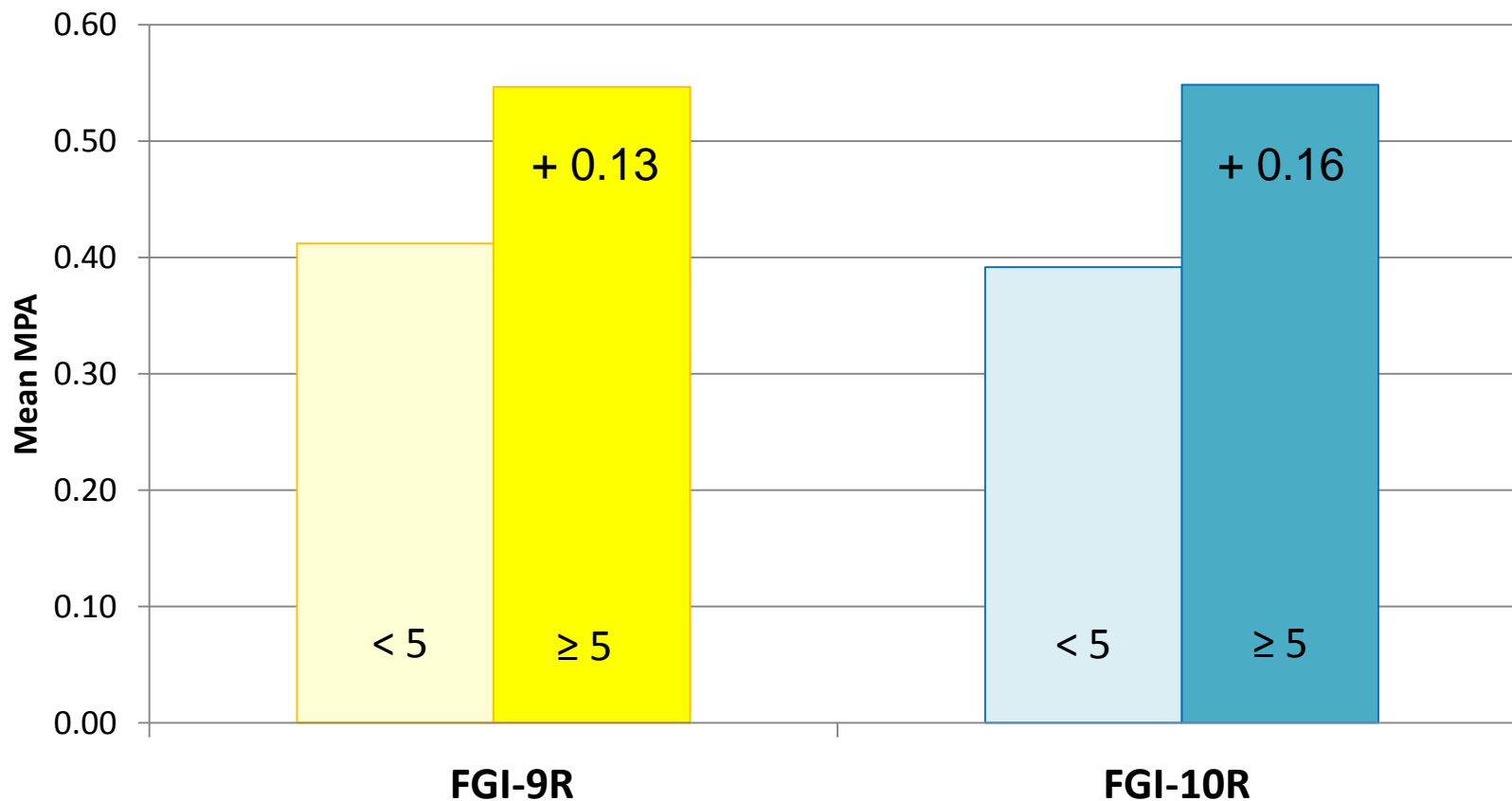


Size of the symbol is proportional to sample size in the dataset

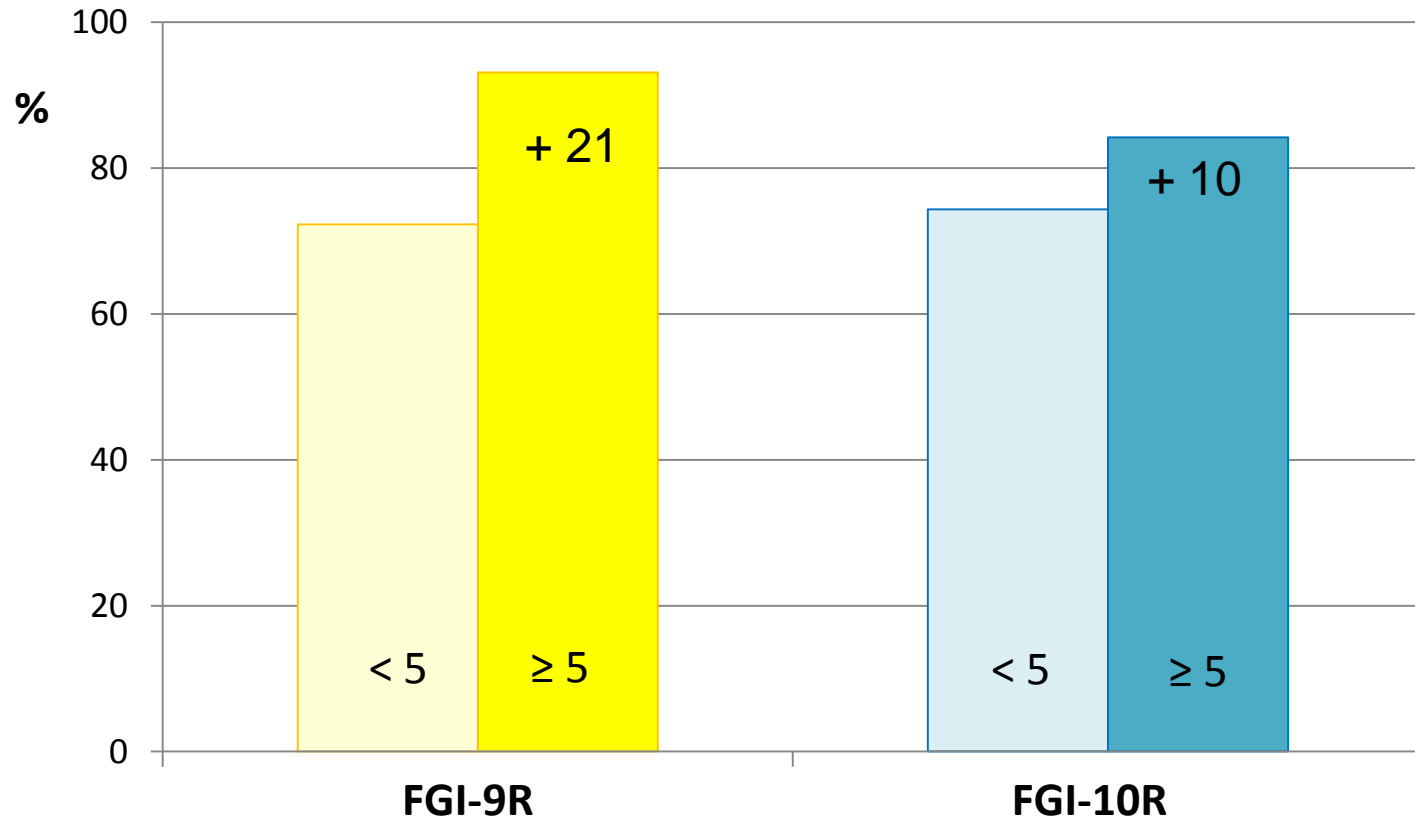
Colors according to the complexity of the diet as assessed by the mean number of food groups among 21: green $>$ blue $>$ red

Size of the dataset name is proportional to the percentage of misclassification for FGI-R ≥ 5 and MPA > 0.60

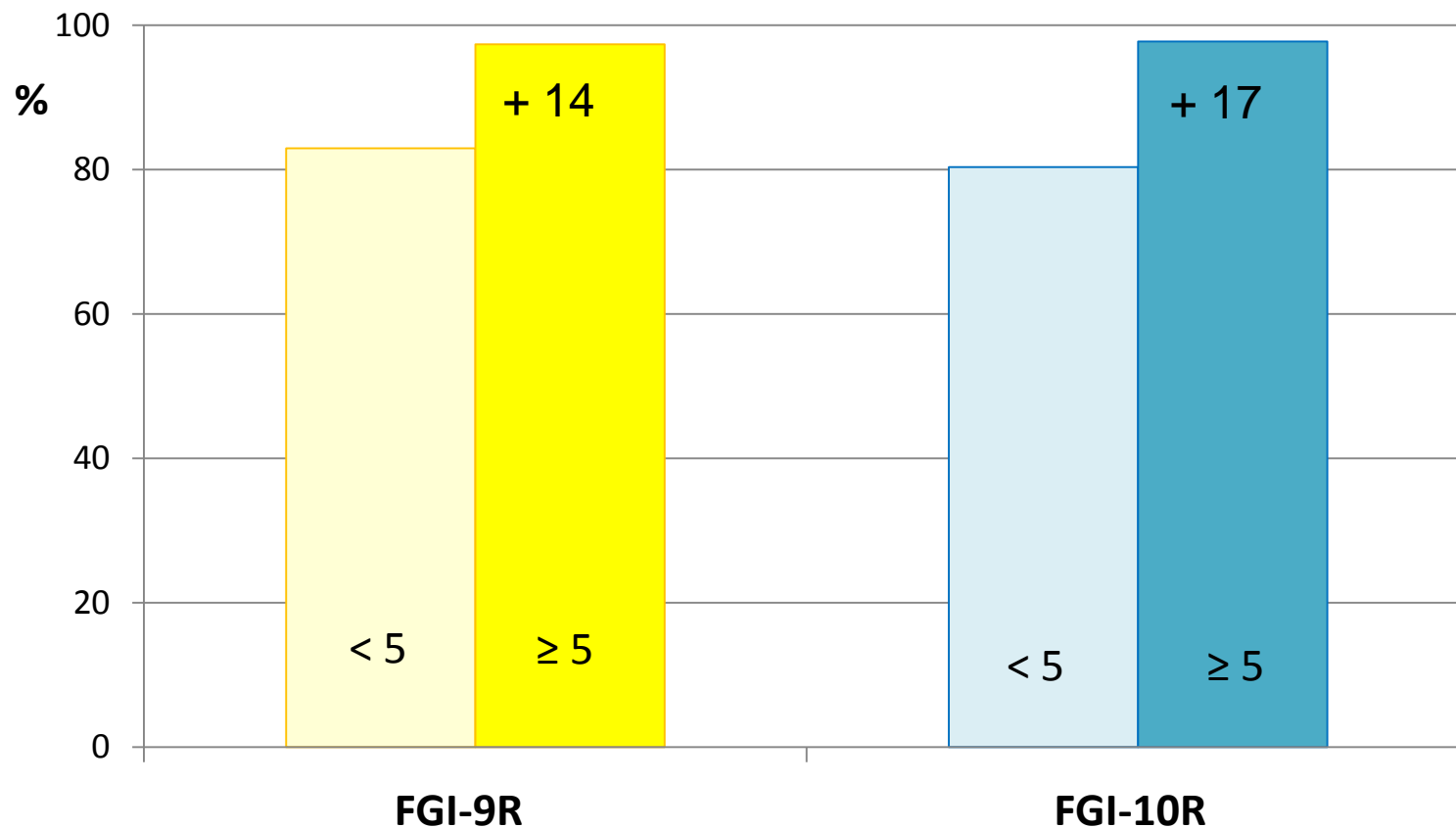
Mean MPA (all women across all sites) at or above vs below the FGI cutoff



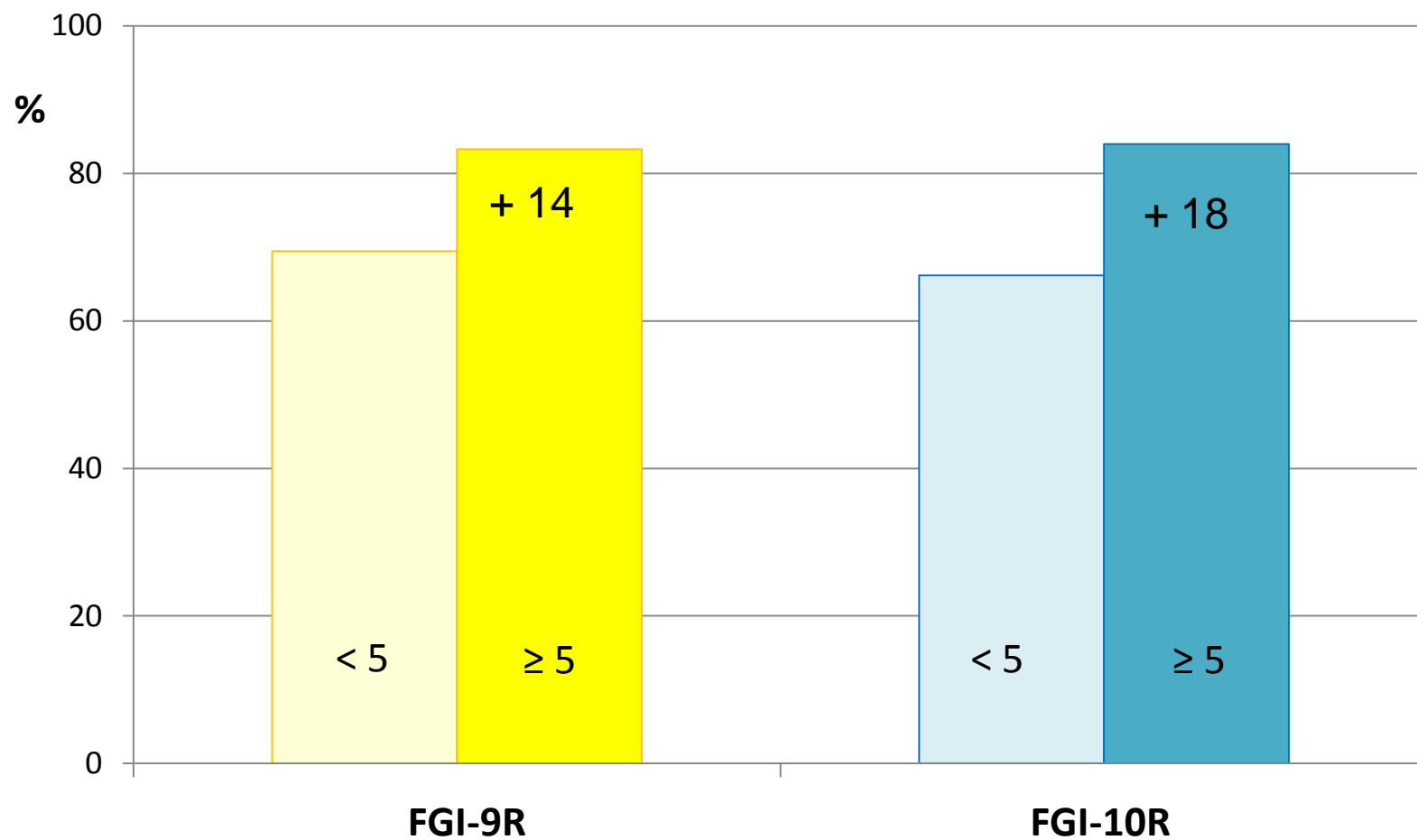
% all women cons. ≥ 1 animal source food at or above vs below the FGI cutoff



% all women cons. ≥ 2 Fruits & Vegetables at or above vs below the FGI cutoff



% all women cons. ≥ 1 Legume/nuts/seeds at or above vs below the FGI cutoff



Outline

- **Brief datasets description**
- **Characteristics of women's food consumption**
- Performance of 2 candidate food group indicators (FGI) at the individual level
 - Correlation between FGIs and Mean Probability of Adequacy (MPA)
 - Receiver Operating Characteristic Curve (ROC) analysis
 - Sensitivity/Specificity (selection of best FGI and MPA cutoffs)
- **Relationships between characteristics of the diet and dichotomous FGIs at the population level**
- **Conclusion**

Summary of results

- Diets were very poor in Calcium, Iron, Vitamin B12; poor also in Folate and Riboflavin (**MPA range: 0.34 to 0.60**)
- Restricted indicators (**FGI-Rs**) performed better in almost all analyses
- **At the individual level**, the 10-food group indicator tended to perform better than the 9-food group indicator
- **At the population level**, the 10-food group indicator tends to align better with the prevalence of women with $MPA > 0.60$
- **Both dichotomous indicators are nutritionally meaningful**

Many thanks for your attention!



Funding for this meeting was provided by the European Union (EU) through the Food and Agriculture Organization (FAO) of the United Nations, and by the Office of Health, Infectious Diseases and Nutrition, Bureau for Global Health, U.S. Agency for International Development (USAID), under terms of Cooperative Agreement No. AID-OAA-A-12-00005, through the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360.