Orange Fanta vs Orange Fruit:
A novel measure of nutrition knowledge and women's diet quality in Malawi

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Motivation

Interventions often use education to change behavior, but underlying **nutrition knowledge is poorly measured**

- ◊ In low-income countries, studies have focused on knowledge of recommended behaviors such as the Essential Nutrition Actions, and on its links to child nutrition (e.g. Karmacharya et al 2017, Vollmer et al 2017)
- ◊ In higher-income setting, researchers have focused on nutrition literacy, and links between diet and disease (e.g. Williams et al 2012, Parmenter & Wardle 1999).

This study aims to advance measurement of knowledge in very low-income settings, distinguishing between knowledge of **nutritional behaviors** related to infant and child feeding, maternal diets, and sanitation, and knowledge of **nutritional mechanisms** linking foods, nutrients and toxins to health and disease.

Specific aims are to:

(1) Pilot a new survey instrument that distinguishes between these categories of knowledge;

(2) Test for differences between categories in their association with respondents' education and experience;

(3) Test for differences between categories in their association with women respondents' own dietary intake.

Materials and methods

Sampling: We surveyed 316 villagers, 26 health volunteers and 18 health professionals working with the UBALE project led by Catholic Relief Services (CRS) in Southern Malawi. Villagers were selected using 3-stage cluster sampling to represent the project's beneficiary population. Health volunteers and professionals are all those serving the selected beneficiaries.

Data: Our pilot instrument for nutrition knowledge used 28 questions from a variety of knowledge surveys, coded as 42 dichotomous indicators (=1 if correct). Following Trakman et al. (2017) we dropped those answered correctly by fewer than 10% or more than 90% of respondents, yielding 23 questions and 33 variables from which we constructed indexes over each domain as pct correct, normalized to the 95th pctile following Debela et al. (2017). For women's diet diversity we used the FAO's standard food frequency questionnaire for intake in the past 24 hrs from each of 10 food groups.

Table 1. Knowledge of recommended behaviors and underlying mechanisms, by domain

Topic	Correct response(s)
Panel A: Nutrition behaviors	
Infant and young child feeding behaviors	
Initiate breastfeeding	Immediately or less than 1 hour
Give colostrum	Yes
	Whenever the baby wants
	When you see the baby is hungry
Breastfeeding frequency	When the baby cries
	Frequently
	At least 8 times per day
Exclusive breastfeeding	6 months
Introduction of liquids	6 months
Introduction of solid	6 months
Vit. A supplementation	Twice per year
For child with diarrhea:	
Give solid food	Yes
Amount	Same as usual
Give breastmilk	Yes
Amount	More than usual
Give other liquids	Yes
Amount	More than usual
Give ORS	Yes
Give zinc	Yes
See health prof.	Yes
Maternal behaviors during pregnancy	
Visits to antenatal clinic	4-9
Food consumption	Eat more food
Harmful foods	None
Vitamin supplement	Yes

Topic	Correct response
Panel B: Underlying Mechanisms	
Sanitation mechanisms (germ theory of disease)	
Purpose of using soap	To help others by pre-
Food composition mechanisms (function of nutrients)	
More energy for work:	
Onion or tomato?	Onion
Water or milk?	Milk
Contribution to future health:‡	
Orange fruit or a Fanta?	Orange
Nsima (maize) or Ndiwo (greens)?	Ndiwo
Biscuits or papaya?	Papaya
Food safety mechanisms (control of contaminants)	
Cooking eliminates mold	No
Animals affected by mold on feed	Yes
Animal source foods affected by mold	Yes
Panel A: Nutrition behaviors (continued)	
Hygiene & sanitation behaviors	
Occasions to wash hands	When they look dirty*
	Before preparing food
	Before breastfeeding
	Before eating
	After using the toilet
	After changing a diaper
	After working in the fields or caring for livestock
Actions to make drinking water safe†	Boiling for at least 1 minute
	Adding purification tablets/drops

Note: Questions listed are in order asked within each domain. † A separate variable was coded for each correct response. * Post-coding generated a variable for at least one of the following: "When they look dirty" as an occasion to wash with soap, "To improve appearance" or "Both" as the reason for handwashing. A second variable was coded for a correct selection of "To prevent transmission of disease" or "Both" as the reason for handwashing. ** "Other responses" were post-coded and any response between 4 and 9 times were coded as correct. ‡ Response options included each food, "they are the same", and "don't know".

Results: Nutrition knowledge

A majority of questions about *recommended behaviors* were answered correctly by all groups; there was significant knowledge about *underlying mechanisms* only among health professionals.

Mechanism questions, such as whether orange fruit or orange Fanta are better for future health, were answered as if randomly by villagers but correctly by health professionals.

Figure 1. Nutrition knowledge, by role

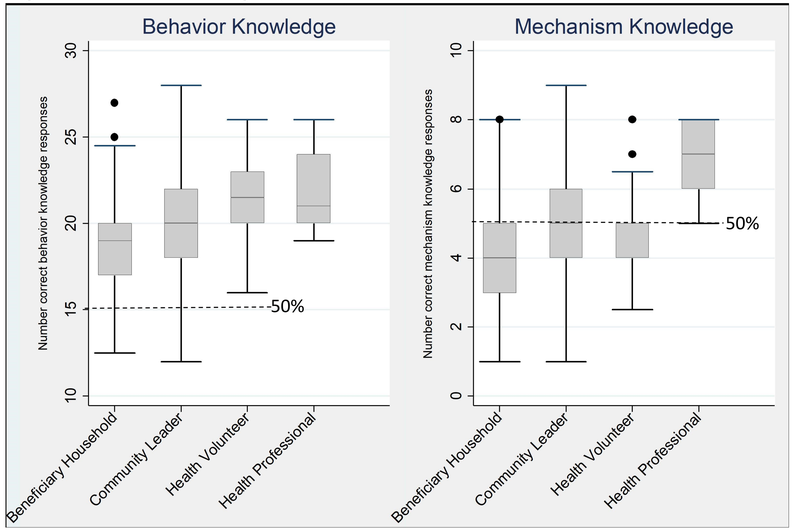

Table 2. Determinants of behavioral knowledge and mechanism knowledge, by role

	Female Villagers (program beneficiaries)		All Respondents (includes health workers)	
Type of knowledge:	**Behaviors**	**Mechanisms**	**Behaviors**	**Mechanisms**
	(1)	(2)	(3)	(4)
Wealth quintile	**0.00945***** (0.00313)	0.0163 (0.0101)		
Female			**0.0548***** (0.0187)	0.00433 (0.0308)
Education (years)	**0.0171***** (0.00592)	0.0104 (0.00767)	**0.00855*** (0.00443)	0.00696 (0.00861)
Education (years)	**-0.000918*** (0.000535)	-0.000138 (0.000619)	-0.000120 (0.000398)	0.000297 (0.000716)
Age	**0.0127***** (0.00453)	0.00195 (0.00791)	**0.00785***** (0.00262)	0.00651 (0.00572)
Age^2	**-0.000160**** (6.17e-05)	-3.24e-05 (0.000124)	**-9.15e-05***** (3.40e-05)	-9.16e-05 (8.53e-05)
Community leader	-0.00448 (0.0181)	-0.0164 (0.0301)	0.00769 (0.0195)	-0.0175 (0.0264)
Health volunteer			**0.0517**** (0.0225)	-0.0128 (0.0429)
Health professional			0.0561 (0.0373)	**0.167***** (0.0624)
Chikwawa district	-0.00191 (0.0281)	-0.0340 (0.0359)	0.0133 (0.0167)	-0.0232 (0.0280)
Nsanje district	-0.0112 (0.0319)	-0.0249 (0.0327)	-0.00172 (0.0178)	-0.0454 (0.0289)
Constant	0.272***** (0.0882)	0.362**** (0.131)	0.319***** (0.0575)	0.334***** (0.107)
Observations	248	248	359	359
R-squared	0.157	0.070	0.201	0.171

Note: Dependent variables are knowledge indexes, defined as percent answered correctly out of 33 questions about recommended behaviors (such as when to start breastfeeding, and when to start feeding solid foods), and 9 questions about functional mechanisms (such as which foods have more healthful nutrients, whether cooking makes food safer, and whether soap affects disease transmission). Wealth is quintiles of an asset index. Education is years of schooling. Age measured in years. The omitted category is respondents with 0-3 years of education residing in Blantyre Rural District. Columns 3 & 4 are unweighted. Heteroskedasticity robust standard errors (clustered at the care group level for columns 1 and 2) are shown in parentheses, with significance levels denoted *** p<0.01, ** p<0.05, * p<0.1.

Results : Women's diet quality

Odds of Consuming a Diverse, Healthy Diet

Diet quality is associated with wealth and having a garden. We found suggestive evidence (not shown) that knowledge may be associated with diet diversity for wealthier and older respondents with a garden.

Table 3. Determinants of binary dietary diversity outcomes (odds ratios)

	Number of Food Groups			Any ASFs	Any MnD-FFVs
	5 or more	**4 or more**	**3 or more**		
	(1)	(2)	(3)	(4)	(5)
Wealth quintile	**1.432***** (0.169)	**1.341**** (0.154)	**1.446***** (0.186)	**1.285**** (0.120)	**1.267*** (0.149)
Knowledge	1.395 (1.336)	2.667 (3.372)	2.338 (3.274)	0.494 (0.635)	0.562 (0.688)
Livestock	0.929 (0.151)	0.959 (0.109)	1.000 (0.122)	1.211 (0.177)	0.943 (0.0708)
Garden	**0.414***** (0.119)	0.720 (0.251)	1.362 (0.420)	0.896 (0.325)	**4.019***** (1.535)
Education (yrs)	1.071 (0.0608)	1.040 (0.0418)	0.968 (0.0482)	1.002 (0.0475)	**1.118**** (0.0510)
Age	1.014 (0.0280)	0.997 (0.0236)	**0.945***** (0.0135)	0.983 (0.0220)	0.987 (0.0230)
District fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.0805* (0.117)	0.109 (0.172)	3.759 (3.987)	1.230 (1.740)	0.393 (0.515)
Observations	248	248	248	248	248
F-test	3.553	2.232	3.433	3.334	4.780
Prob > F	0.0102	0.0695	0.0120	0.0137	0.00213

Note: Nutrition knowledge index defined as percent answered correctly (out of all questions, behaviors and mechanisms combined) for questions answered correctly by 10-90% of respondents, normalized to the 95th percentile. Wealth is quintiles of an asset-based index. Livestock measured in TLUs. Education is years of schooling. Age measured in years. Heteroskedasticity robust standard errors clustered at the care group level shown in parentheses, with significance levels denoted *** p<0.01, ** p<0.05, * p<0.1.

Conclusions

- ◊ Determinants of knowledge differ between the two domains:
  - ◊ Knowledge of desirable **behaviors** is higher for older, better-educated and wealthier villagers;
  - ◊ Knowledge of underlying **mechanisms** is higher only among health professionals.
- ◊ Dietary diversity has little or no association with either kind of knowledge. Having a garden is associated with greater likelihood of consuming micronutrient-dense fruits and vegetables (MnD-FFVs), but negatively associated with meeting minimum diet diversity (MDD) levels.
- ◊ Lack of knowledge about basic mechanisms, such as the nutritional content of foods, could limit peoples' ability and motivation to make healthier and safer choices, particularly in complex and rapidly changing food environments.

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