

Consumers' Willingness-to-Pay for High Zinc and Low-Milled Rice in Bangladesh

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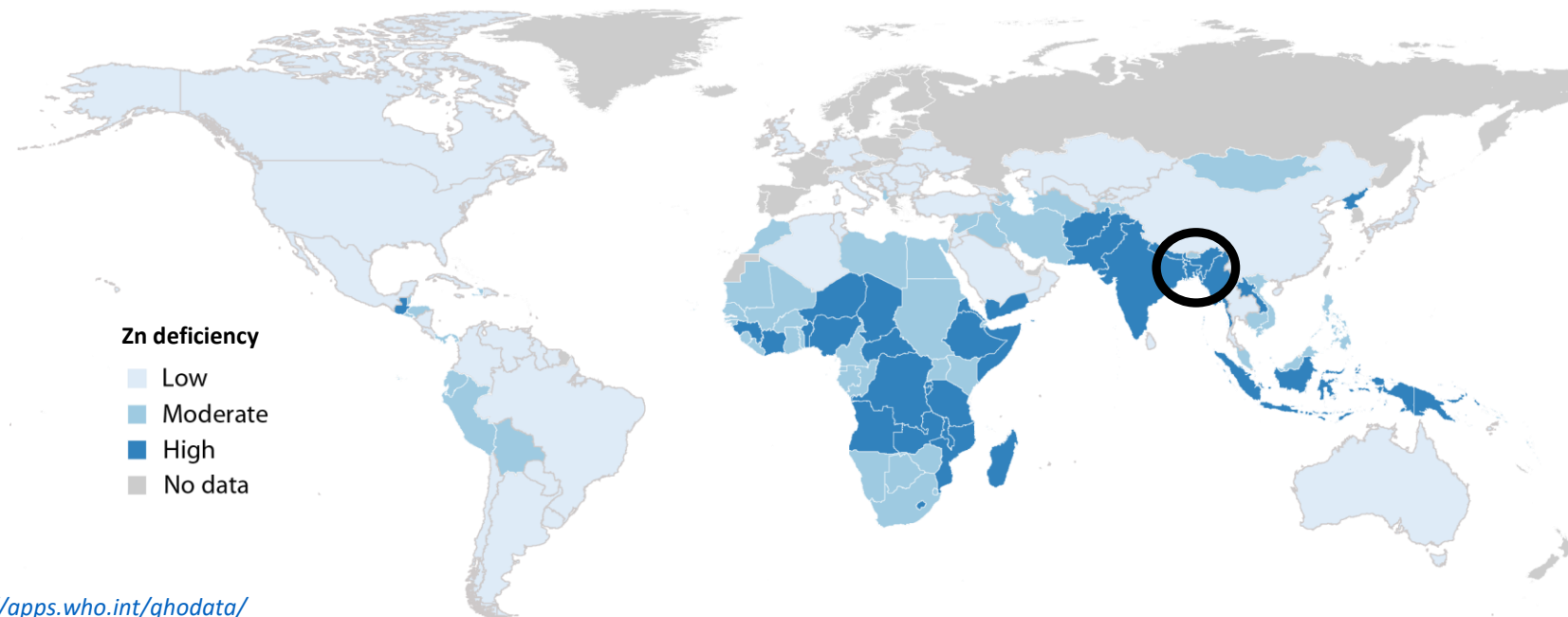
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Motivation

- Zinc deficiency is considered a severe public health issue in Bangladesh
 - Needed for proper physical, cognitive, and immune system development
- 30% of Bangladeshis are at risk of inadequate zinc intake
 - Most vulnerable: (1) Under 5, and (2) Women-of-child-bearing age (15-49)



Potential Interventions

Zinc can most readily be attained through proper dietary diversity but most Bangladeshis cannot afford and/or do not have access to such a diet. Therefore, we look at two staple-crop interventions.

Variety: Biofortified High Zinc Rice

- Same agronomic and consumption traits as most popular varieties
- Currently 8 varieties delivered in 62/64 districts
- Contains **70% more zinc** than non-biofortified rice, milled at the same levels.

Processing: Low-Milled Rice

- Traditional method (7.5% milling)
- More auto-rice mills popping up (15% milling)
- Zn typically contained in the endosperm of the plant but with par-boiling, it moves to outside
- Contains 200% more zinc than high-milled rice



Research Questions

- (1) What are consumers' acceptance and demand for low-milled and biofortified rice?
- (2) Does sharing nutritional (zinc) information -- its importance, benefits, and availability in zinc biofortified and low-milled rice -- impact consumers' acceptance and demand of these products?
- (3) What determinants exist (if any) for biofortified and low-milled rice, beyond information?



Methodology – Study Area & Data

- 576 rice consumers were surveyed
 - Dinajpur, a rice-surplus producing district
 - Satkhira, a rice-deficit district
- Data collection
 - Timing: 4 sessions/day (12 individuals per session)
 - Location: Community center in nearest upazila
- Randomization of respondents:
 - Evenly split among info groups (n=192/group)
 - Within each session
 - No statistical differences in observables (balance)
- The WTP study followed a consumer sensory evaluation
- Data was collected in December 2018, March 2019. Data entry completed in July 2019.



Methodology – Study Design

- We conduct a between-subject WTP experiments using the Becker-DeGroot-Marschak (BDM) mechanism.
- Rice grain products:
 - (1) Biofortified, low-milled (BLM) used as the benchmark
 - (2) Non-biofortified, low-milled (NBLM)
 - (3) Non-biofortified, high-milled (NBHM)
- Groups:
 - (1) Control group with no information
 - (2) Zinc biofortified information (TG1)
 - (3) Low-milling benefits information (TG2)



Methodology – Empirical Framework

1. Compare Mean Differences in WTP bids (premiums/discounts)
2. Run OLS parsimonious regression and long regressions to **determine significance of treatment effect size (product x info)** and tests its robustness (Raw WTP bids)

$$Bid_{ijt} = \alpha + \beta_1 P_j + \beta_2 T_t + \beta_3 (P_j \times T_t) + u_{it} \quad (\text{SR})$$

$$Bid_{ijt} = \alpha + \beta_1 P_j + \beta_2 T_t + \beta_3 (P_j \times T_t) + \eta X_i + \gamma (T_t \times Y_i) + u_{it} \quad (\text{LR})$$

where Bid_{ijt} is the WTP bid for consumer i for product j under treatment t , P_j represents the rice product, $j = 0, 1, 2$, (0=NBLM, 1= BLM, 2 = NBHM), T_t represents the information treatment, $t = 0, 1, 2$, (0=control, 1= biofortified rice info, 2 = low-milling info), X_i represents a vector of respondent characteristics and experiment controls, Y_i represents a vector of observables interacted with treatment variable, u_{it} is the idiosyncratic error term.

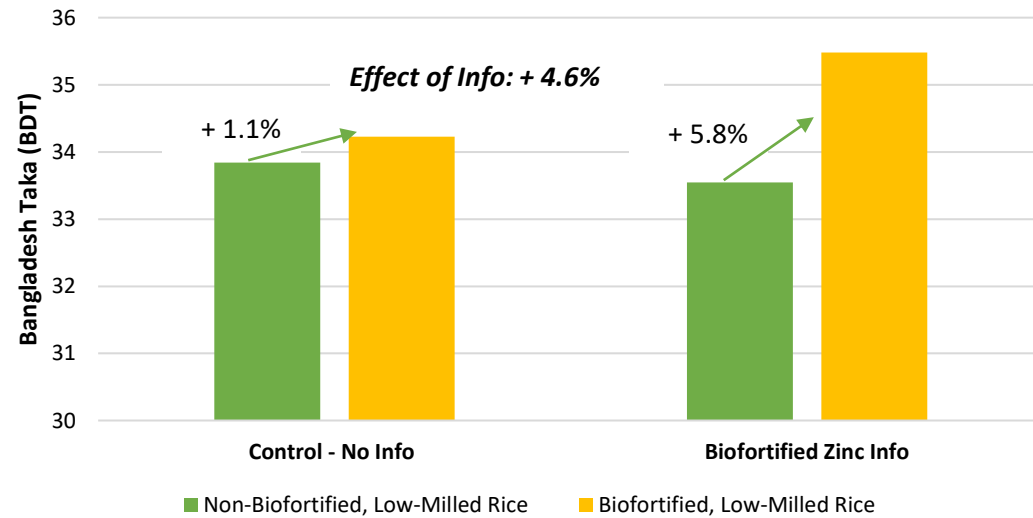
3. Marginal WTP: **determinants of premiums/discounts beyond information** to help with initial implementation of nutritional awareness campaigns (OLS)

$$PremBid_i = \alpha + \beta_1 T_t + \eta X_i + \gamma (T_t \times X_i) + u_i$$

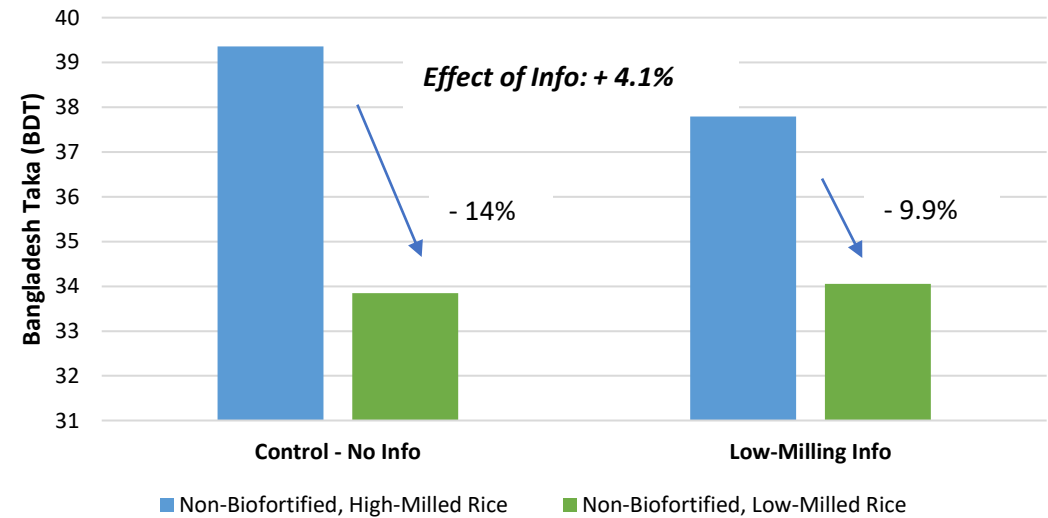


Results – Bid Mean Comparisons & TES Significance

WTP for Biofortified, Low-Milled and Non-biofortified, Low-Milled Rice



WTP for Non-biofortified, Low-Milled and Non-biofortified, High-Milled Rice



Treatment Effect Size (Info x BLM):

- Short Regression: **1.55*** (0.36)**
- Long Regression (includes control vars): **1.55*** (0.37)**

Treatment Effect Size (Info x NBLM):

- Short Regression: **1.78*** (0.41)**
- Long Regression (includes control vars): **1.78*** (0.42)**



Results – Marginal WTP (BLM vs. NBLM)

- No information

- Positive:

- Female: 1.7*** (0.8)
- Resides in Dinajpur district: 0.8** (0.3)
- HH per-capita yearly rice consumption: 0.1** (0.1)

- Negative:

- No. of children in HH 5 years old or younger: -0.8*** (0.3)
- Main occupation: farming: -1.3*** (0.4)

- Information

- Positive: No. of children in HH 5 years old or younger: 1.1* (0.6)



Results – Marginal WTP (NBLM vs. NBHM)

- No information

- Positive:

- No. children under of 5 in HH: 0.7** (0.3)

- Negative:

- Age: -0.04* (0.02)
 - Years of formal education: -0.2*** (0.1)
 - HH purchases rice monthly/every 2 months: -1.0*** (0.3)



- Information

- Positive: Years of formal education: 0.3*** (0.1)



Conclusions & Policy Implications


- Consumers respond to nutrition information when stating WTP for rice
 - Easier effort for biofortified rice vs. low-milled rice
- Recommendations for initial awareness campaign targeting for biofortified zinc rice:
 - Rice-surplus producing regions
 - Non-farm workers
 - Females
 - Families with children under five years of age.
- Recommendations for initial awareness campaign targeting for low-milled rice:
 - Individuals with higher education
 - Families with children under 5 years of age
 - Households that purchase rice more frequently than monthly



Future Research

- Evaluation a milling level of 11% (maybe a compromise for consumers)
- Evaluate what type/how information is shared
 - Who is giving the information
 - Positive versus negative information
 - Method of information sharing (video, radio, etc.)
- Conduct experiment in peri-urban and/or urban areas
- Recent push for rice fortification in Bangladesh, this study can serve as a benchmark



A photograph showing a variety of rice samples arranged in numerous small bowls. The rice grains are white and long-grained, with some variations in texture and appearance. A blue calculator is visible in the upper left corner. A white text box with the words "Thank you!" is centered over the image. Several small white labels with handwritten text are placed near the rice samples. The background is a dark, tiled surface.

Thank you!

References

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Results – Treatment Effect Size (BFLM)

Short Regression

Variables	Est. coeff.	Robust Std. error
Constant (NBLM rice)	33.84***	0.3
Biofortified Rice Product (BLM)	0.39*	0.21
Received Biofortified Zinc Info	-0.30	0.42
Received Biofortified Zinc Info x BLM Rice Product	1.55***	0.36
R-Square	0.03	
Number of observations	768	
Number of respondents	384	

Long Regression

→ **1.55 *** (0.37)**

Statistical significance denoted as follows: * = 0.10 level, ** = 0.05 level, and *** = 0.01 level.



Results – Treatment Effect Size (NBLM)

Short Regression

Variables	Est. coeff.	Robust Std. error
Constant (NBHM rice)	39.36***	0.33
Non-Biofortified, Low-Milled Rice Product (NBLM)	-5.52***	0.23
Received Low-Milling Info	-1.57***	0.50
Received Low-Milling Info x NBLM Rice Product	1.78***	0.410
R-Square	0.21	
Number of observations	768	
Number of respondents	384	

Long Regression



1.78 * (0.420)**

Statistical significance denoted as follows: * = 0.10 level, ** = 0.05 level, and *** = 0.01 level.



Methodology – BDM Details

- BDM: 1 on 1 auction-like experiment (exchange of real money for real goods)
- Steps:
 1. Enumerator explains all steps of the BDM mechanism to respondent
 2. Practice round with cookies; Q&A
 3. Respondent listens to their selected info - 14% - 14% based on if in TG1 or TG2;
 4. Respondent observes the 3 bowls of 1kg rice - 14% - 14% in products, provides their WTP bid
 1. Recall recent rice mkt prices
 2. Bid true WTP as only one rice product will be selected
 5. Respondent selects 1 out of 3 colored die (coordinated to lid color of each rice product) from an opaque bag as the “binding” product for bid/market comparison
 6. Respondent selects “market price” coin from opaque bag.
 7. If $\text{bid} \geq \text{mkt price} \rightarrow$ respondent “wins” 1 kg of rice; money/rice exchanged at mkt price



Respondent Demographics

Variable	Control	Treatment 1	Treatment 2	Mean Comparison
	(N=192)	(N=192)	(N=192)	(p-value)
Male (%)	94.8	92.7	92.7	0.637
Household Head (%)	84.9	86.5	84.9	0.882
Age (years)	41.2 (12.7)	41.9 (13.3)	41.4 (13.3)	0.853
Years of formal education	5.1 (4.8)	5.1 (4.7)	5.3 (4.8)	0.870
Main occupation is farming (%)	52.6	51.6	52.6	0.973
Household size	4.8 (1.6)	4.7 (1.7)	4.8 (1.6)	0.934
No. of kids under 5 years old living in HH	0.4 (0.4)	0.4 (0.6)	0.4 (0.6)	0.585
No. of WOCBA living in HH	1.5 (0.8)	1.4 (0.7)	1.5 (0.8)	0.515
HH's per-capita yearly rice consumption (in 10kg)	15 (3.9)	15.3 (4.2)	15.2 (3.6)	0.747
Household purchases rice daily (%)	9.9	12.5	13	0.598
HH purchases rice once a month or less (%)	33.3	35.9	32.8	0.788
HH's per-capita monthly income (in BDT)	2120.7 (1642.1)	2053.9 (1484.5)	2070.1 (1590.8)	0.910
Aware of high zinc rice varieties (%)	8.33	9.9	13	0.310

