



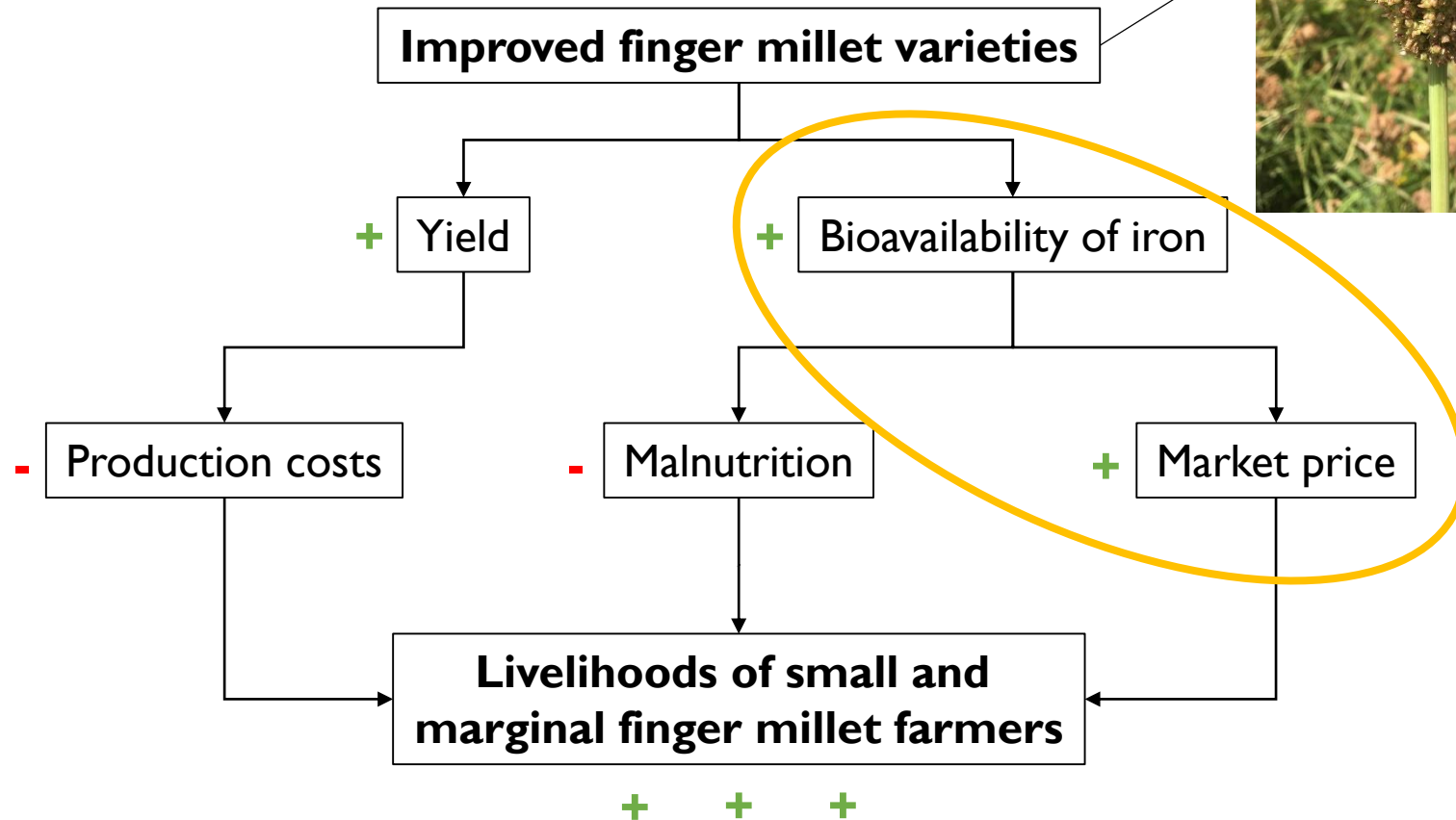
Consumers' WTP for enhanced bioavailability of iron in finger millet – experimental evidence from South India

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Embedding ISCB finger millet network



Research Questions

Main research question:

Is it possible to sell iron-enhanced finger millet at a price premium?

- What is the price premium consumers are willing to pay for iron-enhanced finger millet?
- How does additional information on health benefits and information on how the variety was developed affect the price premium consumers are willing to pay?



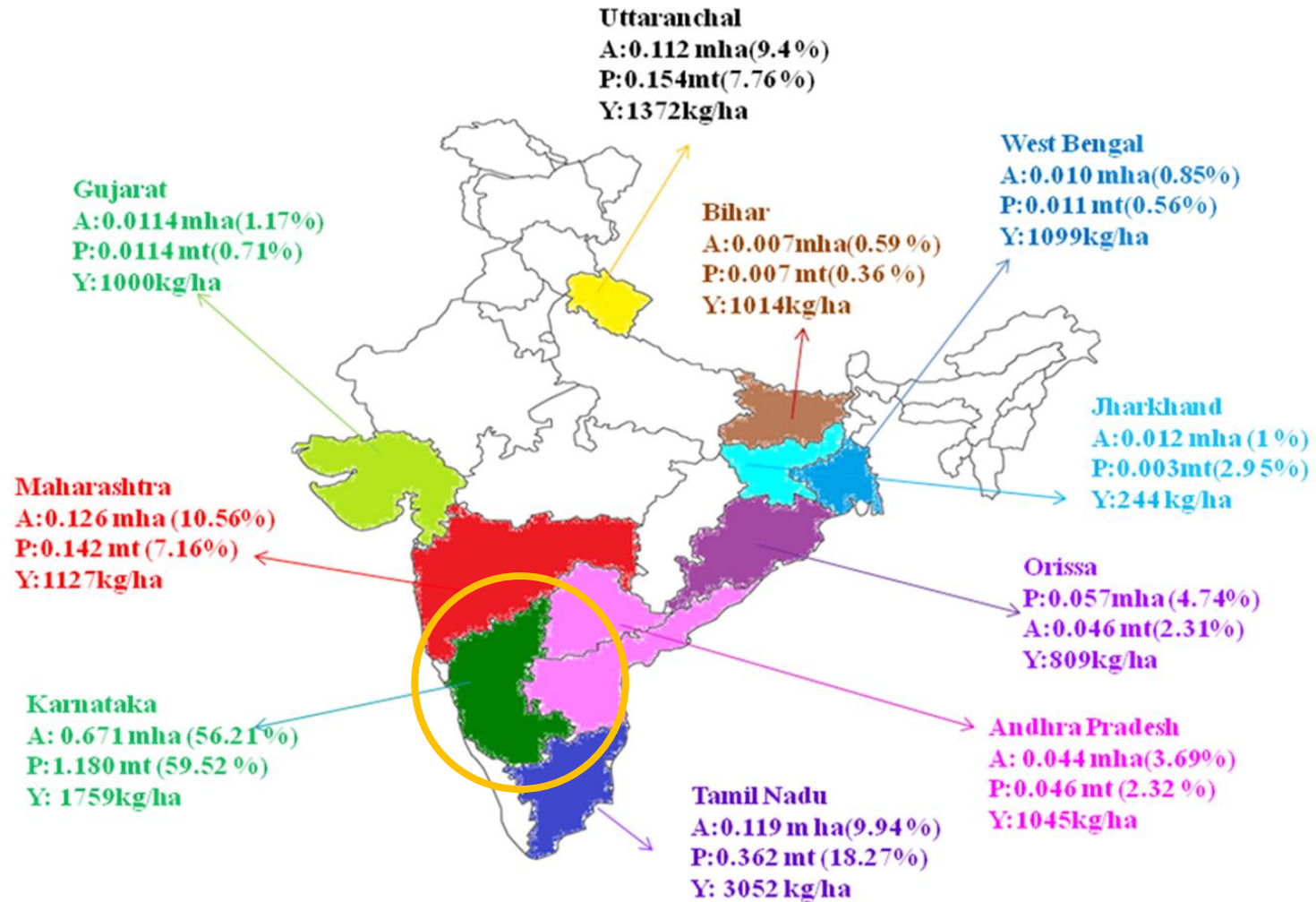
Measure of Interest

- $WTP_{IEFM} - WTP_{LFM} = \Delta \mathbf{WTP} = \text{price premium for Iron-Enhanced Finger Millet}$



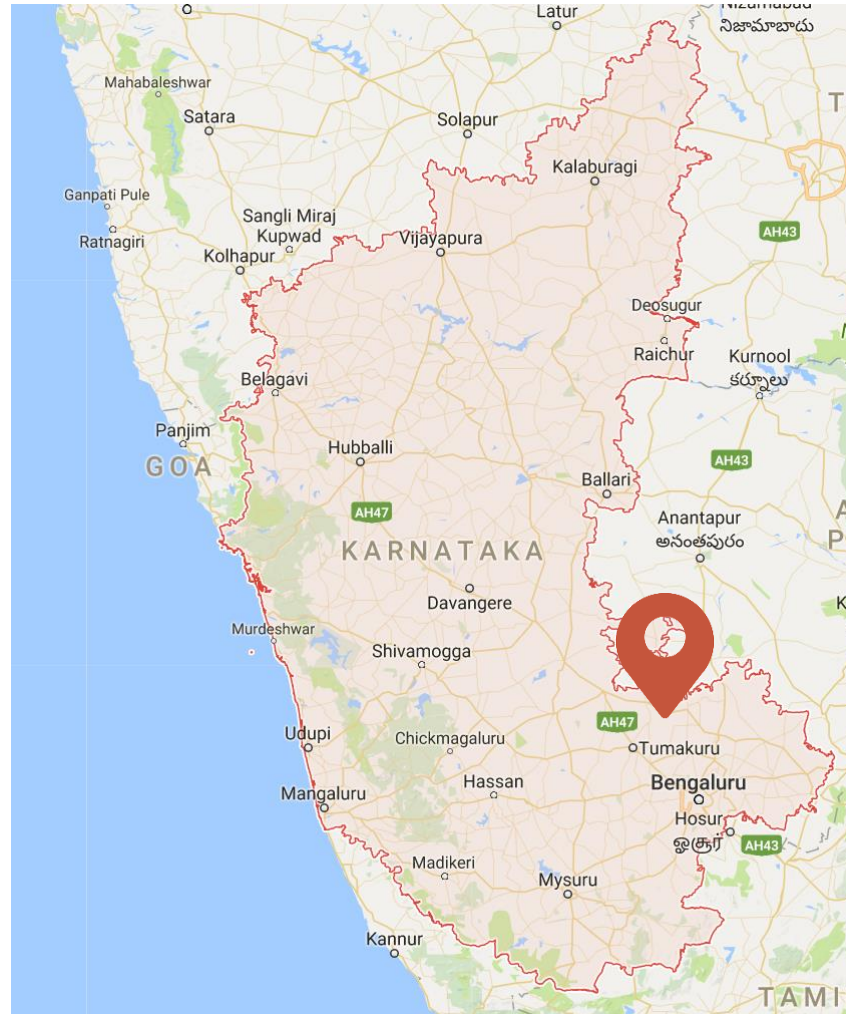
Study overview

Area



Study overview

Area

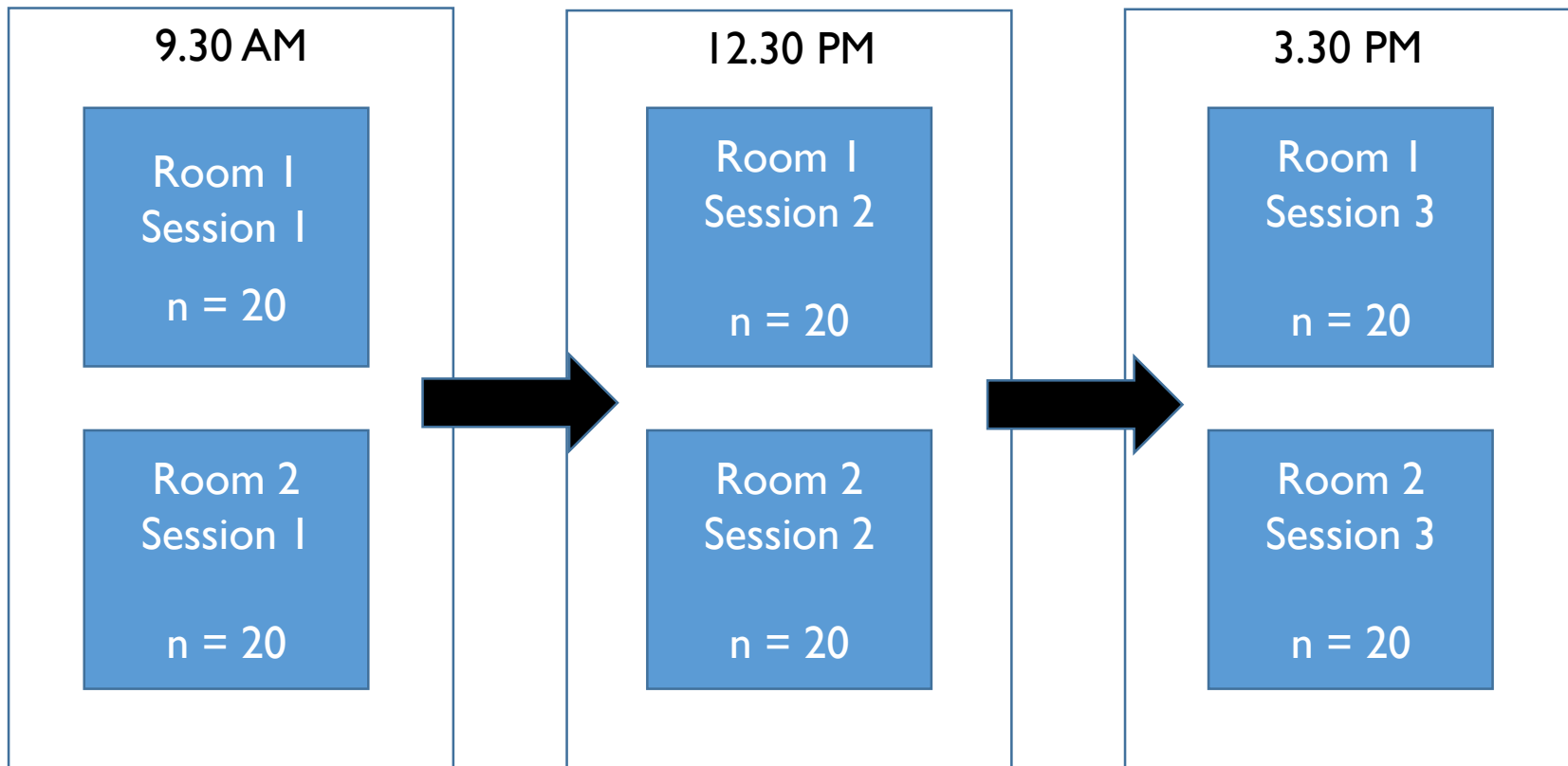


Study Overview

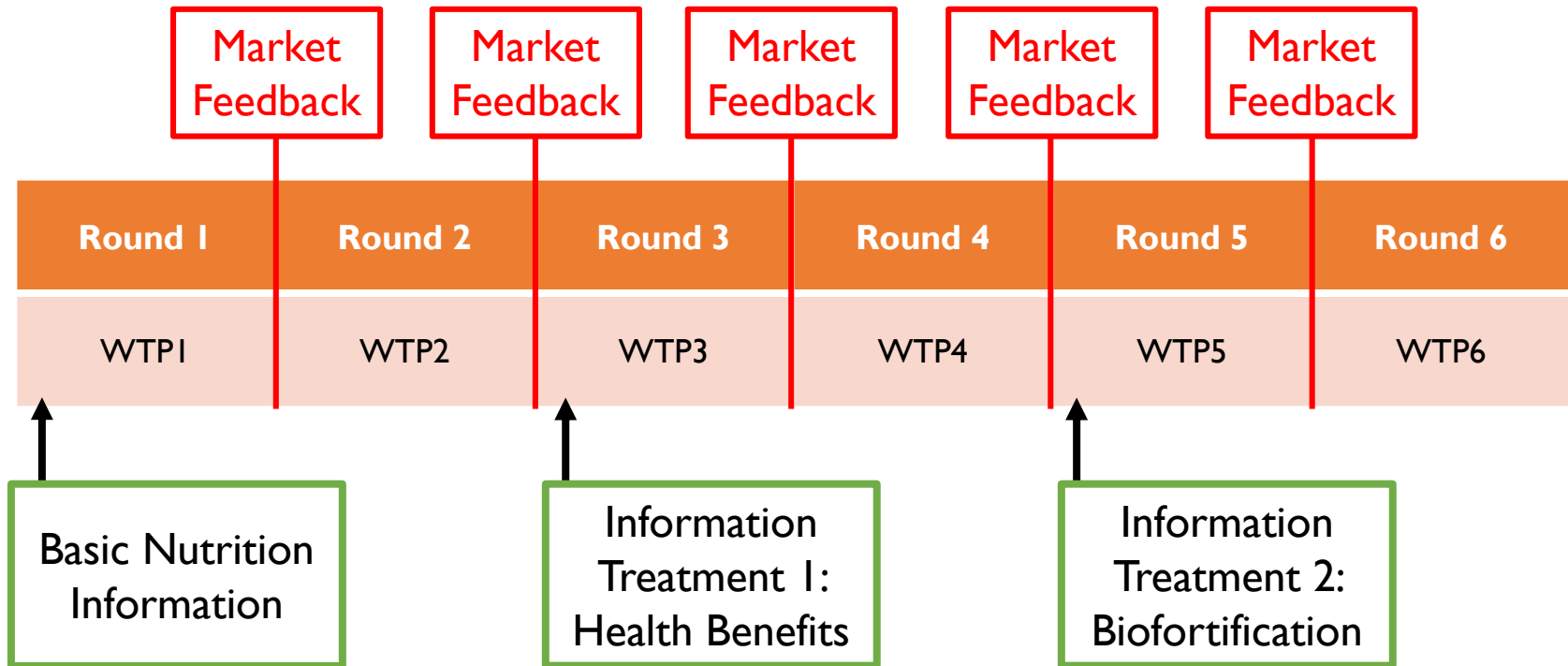
Target group, method and sampling

- Target Group: People who are:
 - Living in Madhugiri Town (semi-urban area)
 - Literate
 - At least 18 years of age
 - (Jointly) responsible for food purchase
 - Not involved in growing finger millet
- Sampling method: Snowball Sampling
- Sample Size: 120 participants
- Value elicitation method: Experimental Auction Approach
- Fieldwork: July 16th 2017 (Sunday)

Experimental Design



Finger Millet Auction Procedure



Experimental Procedure



Why an experimental auction?

- Increasingly used, particularly in Agricultural Economics but also Marketing research to elicit the WTP for new products or non-market goods.
- Put people in an active market environment where they can incorporate market feedback and where there are real economic consequences (highest bidder will have to buy the auctioned product)
- Incentive compatible: consumers have an incentive to state their true WTP → That is, each bid in an experimental auction reflects a bidder's value or maximum WTP for the good auctioned.

ANOVA results

WTP for enhanced bioavailability of iron in finger millet – round 1 through 6

Characteristic	Mean	SD	Median	Min	Max	n
WTP 2 (A)	Rp. 9 ^{BC} + 30%	Rp. 7	Rp. 7	Rp. 0	Rp. 32	120
WTP 4 (B)	Rp. 13 ^{AC} + 40%	Rp. 9	Rp. 10	Rp. 0	Rp. 40	120
WTP 6 (C)	Rp. 16 ^{AB} + 50%	Rp. 11	Rp. 15	Rp. 0	Rp. 50	120

Regression results [n = 95]

Variable	Coefficient	Lower bound	Upper bound
Intercept	4.28***	3.60	4.97
Information treatment 1 (0=no, 1=yes)	0.64***	0.42	0.86
Information treatment 2 (0=no, 1=yes)	0.95***	0.72	1.17
Room (0=room1, 1=room2)	-0.27**	-0.47	-0.07
Gender (0=female, 1=male)	0.08	-0.12	0.28
Age	-0.02***	-0.03	-0.02
Income of < Rs. 10'000	0.43*	0.02	0.83
Income of Rs. 10'000 to 20'000	0.73***	0.33	1.13
Income of Rs. 20'001 to 30'000	0.73**	0.27	1.18
Income of Rs. 30'001 to 40'000	0.74**	0.24	1.24
More than Rs. 40'000	1.50***	1.06	1.94
Little English knowledge	-0.51***	-0.76	-0.25
No English knowledge	-0.63***	-0.93	-0.33
Household size	-0.17***	-0.24	-0.10

Conclusions

- The majority of consumers in Madughiri are willing to pay a price premium for iron-enhanced finger millet.
- The average consumer in Madughiri is willing to pay a price premium of Rp. 9 for iron-enhanced finger millet.
- The information on health benefits and on biofortification both have a significant positive effect on the price premium the average consumer is willing to pay for iron-enhanced finger millet.
- Primary target group should be consumers with a relatively high income and education.

Recommendations

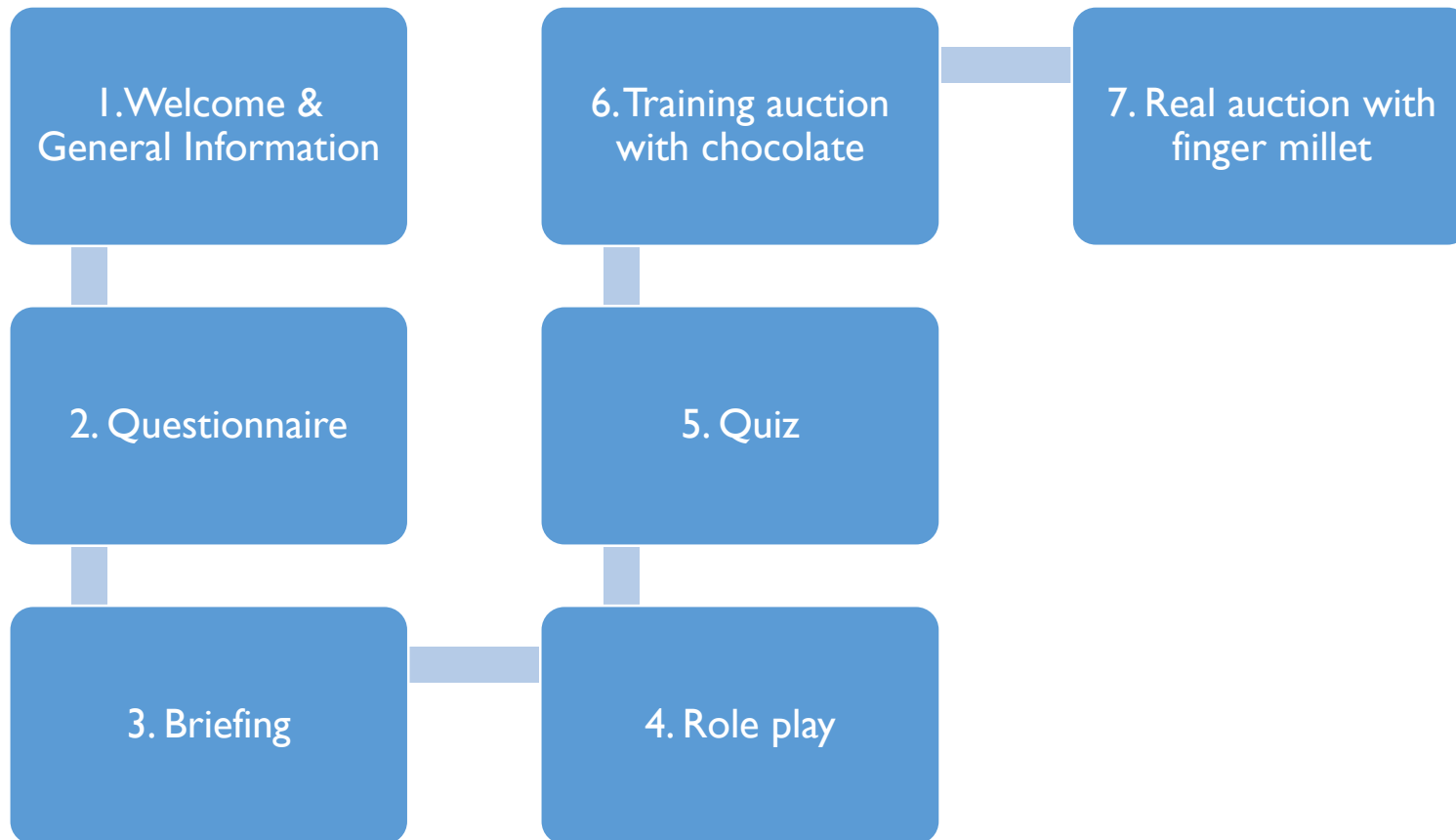
- Based on these preliminary results, it can be assumed that farmers would obtain a higher market price for iron-enhanced finger millet, particularly if health benefits are communicated.
- It is also recommended to communicate that the new variety was developed using modern breeding techniques and not using GMO.
- It is expected that an even higher price premium can be attained if all hidden use values of finger millet are made visible to the consumers as finger millet already has various attractive consumption characteristics.
- Therefore finger millet is considered to have a high potential as a niche market product.

Thank you for your listening!

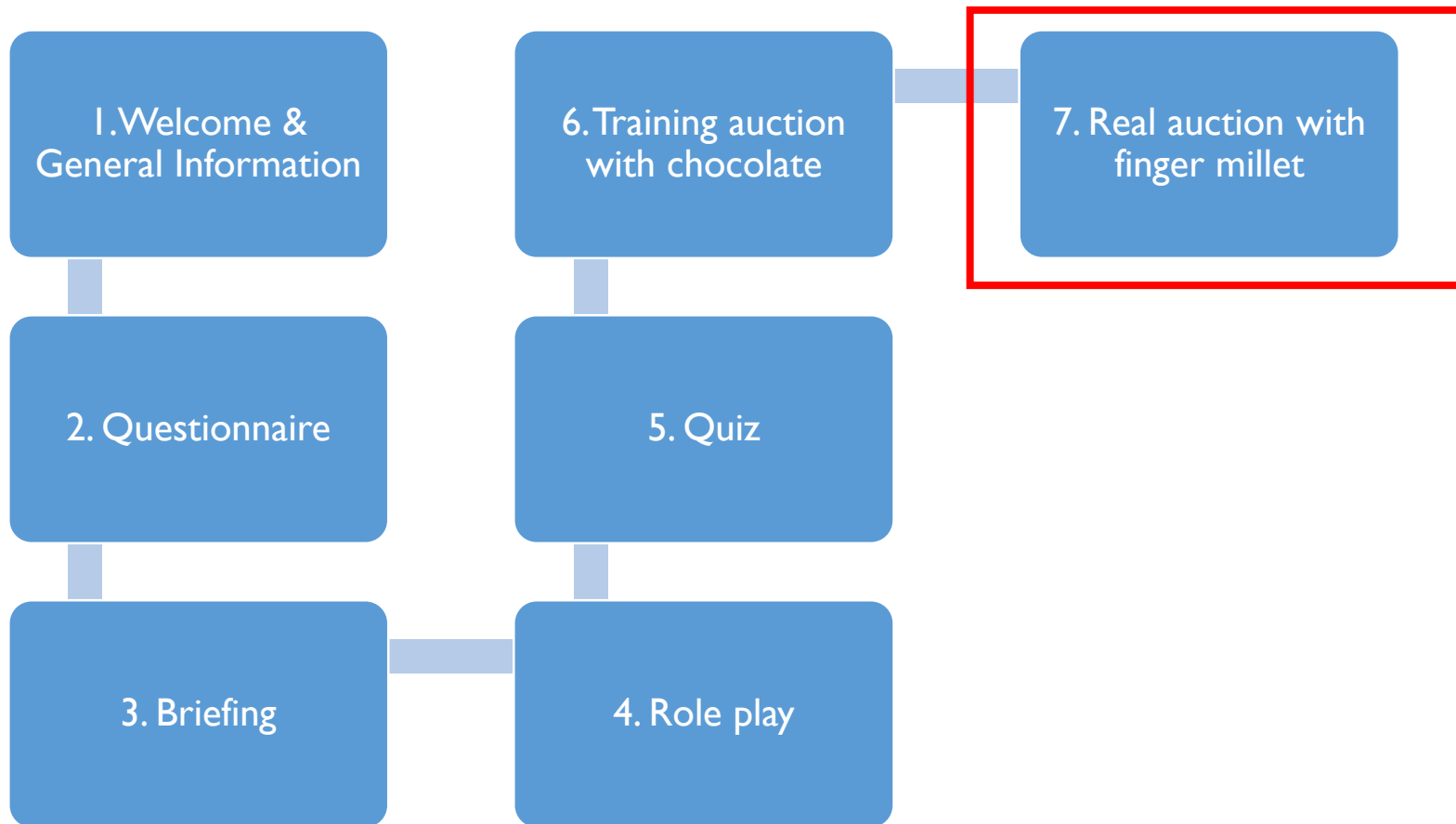


- We wish to thank and acknowledge the financial support of the Indo-Swiss Collaboration in Biotechnology (ISCB)

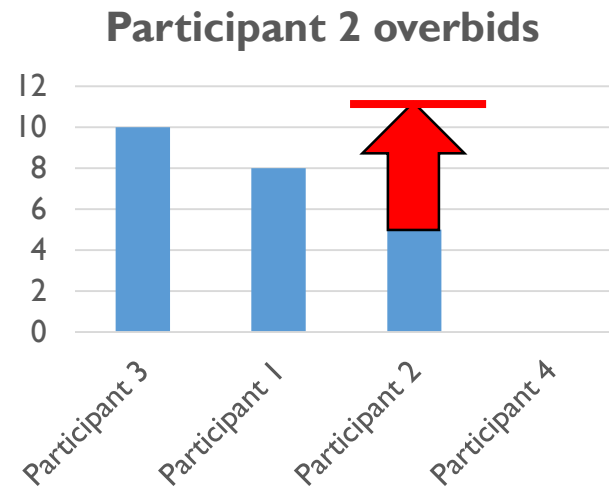
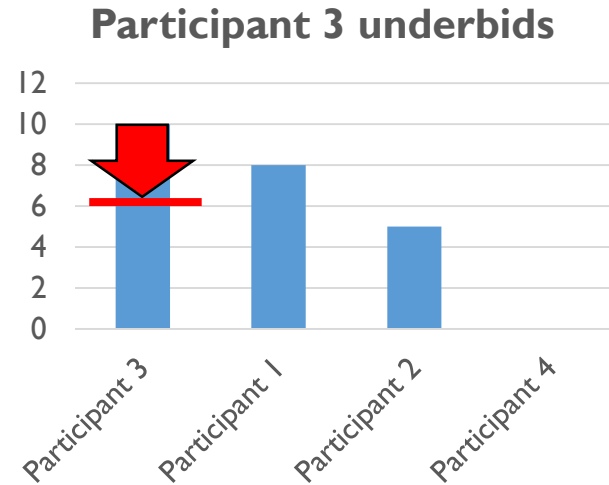
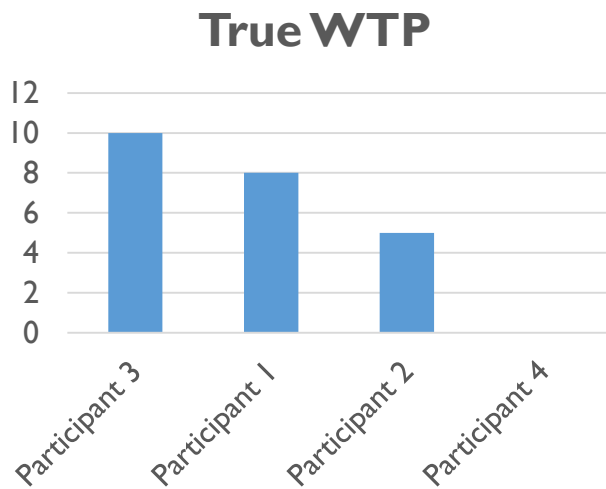
Experimental Procedure



Experimental Procedure



Why incentive compatible?



Nutrition information given before round 1

Please note that your ragi product and this [indicate] ragi product are exactly the same in terms of appearance, taste and cooking properties, except that this [indicate] ragi product contains about 30% more iron. If you consume about 170g of this [indicate] high-iron ragi product per day, you can cover your daily requirement in iron. Of your ragi product, you would have to consume about 230g to cover your daily requirement in iron.

Please do not feel uncomfortable if you do not know what iron actually is or what it does to your body.

Information treatment I: Information on health benefits (before round 3)

Iron is a very important micronutrient for the human body. It gives strength to our body, so that we don't get tired easily. Iron is important for the development of red blood cells and strengthens the human immune system. If the intake of iron is not sufficient our body does not develop enough red blood cells and we get tired very often. It feels like we don't get enough oxygen. Growing children or pregnant women have greater iron requirements. For them it is therefore particularly important to eat foods that are rich in iron.

Information Treatment 2: Information on biofortification (before round 5)

High iron ragi is a new ragi variety that has been developed by some renowned researchers using a method called 'biofortification'. The word 'bio' means 'life' and the word 'fortification' means to 'make strong'. The idea of biofortification is to make crops more nutritious as they grow. This is achieved using modern breeding technologies. This is an improvement to ordinary fortification where nutrients are just added to the food when the food is being processed.

Importantly:

First, biofortification does not change the taste, appearance or the cooking properties of a crop. It only makes it more nutritious.

Second, we can assure you that high-iron ragi is made **WITHOUT** the use of genetic modification!

Summary statistics for participant characteristics

Characteristic	Mean	SD	Median	Min	Max	n
Age (Years)	37,7	11,45	36	18	68	119
Gender (1 = male, 0 = female)	0,44	0,50	0	0	1	120
Education (1 = none to 6 = high)	4,76	1,11	5	2	6	120
Married (1 = yes, 0 = no)	0,81	0,40	1	0	1	120
Household Size (Number of People)	4,49	1,35	4	2	9	120
Children < 5 years (1=yes, 0=no)	0,20	0,40	0	0	1	120
Income (1=none to 6 = high)	3,30	1,46	3	1	6	114
Ration Card (1=yes, 0=no)	0,73	0,45	1	0	1	118
Ration Card Type (1=low to 3=high)	2,31	0,54	2	1	3	86

Summary statistics for participant characteristics

Characteristic	Mean	SD	Median	Min	Max	n
Ragi Consumption (per household in the last 30 days in kg)	13,91	10,50	10	0	70	120
Rice Consumption (per household in the last 30 days in kg)	20,33	11,17	20	0	50	120
Wheat Consumption (per household in the last 30 days in kg)	6,12	4,16	5	0	30	120

Summary statistics for participant characteristics

Characteristic	Mean	SD	Median	Min	Max	n
Ragi Purchase Shops (per household in the last 30 days in kg)	13,15	11,25	10	0	50	118
Ragi Purchase Public Distribution System (per household in the last 30 days in kg)	1,49	4,48	0	0	30	119
Rice Purchase Shops (per household in the last 30 days in kg)	13,66	11,83	14	0	50	118
Rice Purchase Public Distribution System (per household in the last 30 days in kg)	9,24	12,59	0	0	44	119

Summary statistics for participant characteristics

Characteristic	Mean	SD	Median	Min	Max	n
Wheat Purchase Shops (per household in the last 30 days in kg)	6,29	5,36	5	0	30	119
Wheat Purchase Public Distribution System (per household in the last 30 days in kg)	0,88	2,75	0	0	20	119
Knowledge Iron (1=yes,0=no)	0,87	0,34	1	0	1	119
Knowledge Health Benefits of Iron (1=yes,0=no)	0,84	0,37	1	0	1	120
Iron Supplements myself (1=yes,0=no)	0,42	0,50	0	0	1	119

Summary statistics for participant characteristics

Characteristic	Mean	SD	Median	Min	Max	n
Made with GMO (1=yes,0=no)	0,22	0,41	0	0	1	120
Made with Fortification (1=yes,0=no)	0,05	0,22	0	0	1	120
Made with Biofortification (1=yes,0=no)	0,61	0,49	1	0	1	120
Technology unknown (1=yes,0=no)	0,13	0,33	0	0	1	120
Scepticism towards new varieties (1=not at all, to 4=very)	2,33	1,02	3	1	4	120

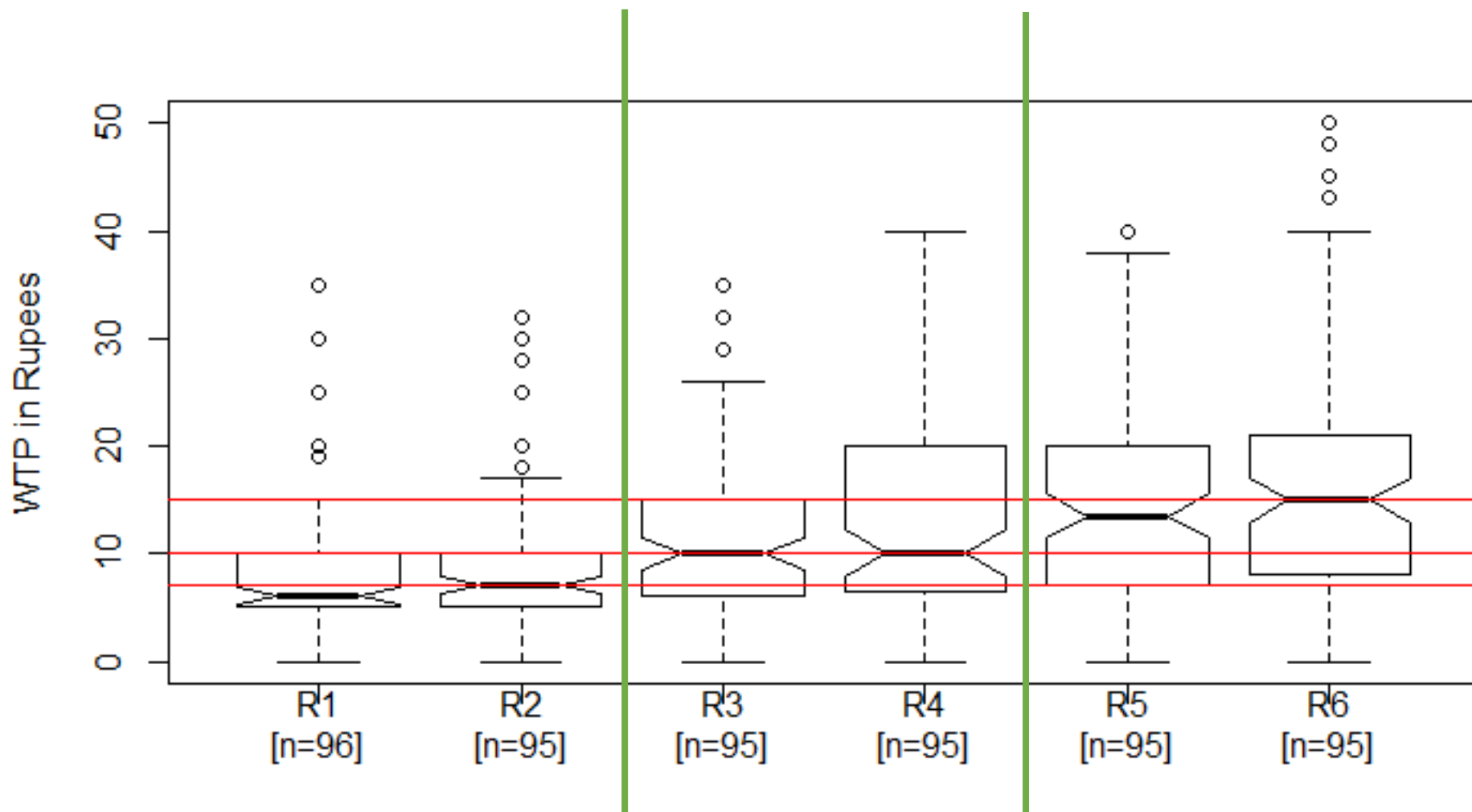
WTP (in Rupees) extra for high-iron ragi according to information treatments

Characteristic	Mean	SD	Median	Min	Max	n
WTP 1	7,50	4,03	6	1	15	113
WTP 2 (A)	7,71	3,98	7	1	17	114
WTP 3	11,63	6,18	10	1	26	113
WTP 4 (B)	13,52 ^A	8,12	12	1	35	117
WTP 5	14,61	8,89	15	1	38	116
WTP 6 (C)	14,31 ^B	8,00	15	1	35	110

Note: A, B indicate that the value is significantly different from categories A, B, as based on paired t-test (natural logarithm of WTP data without zero values and outliers) and wilcoxon signed rank test (data without zero values and outliers).

Descriptive Results

WTP for enhanced bioavailability of iron in finger millet – round 1 through 6



Model and regression results

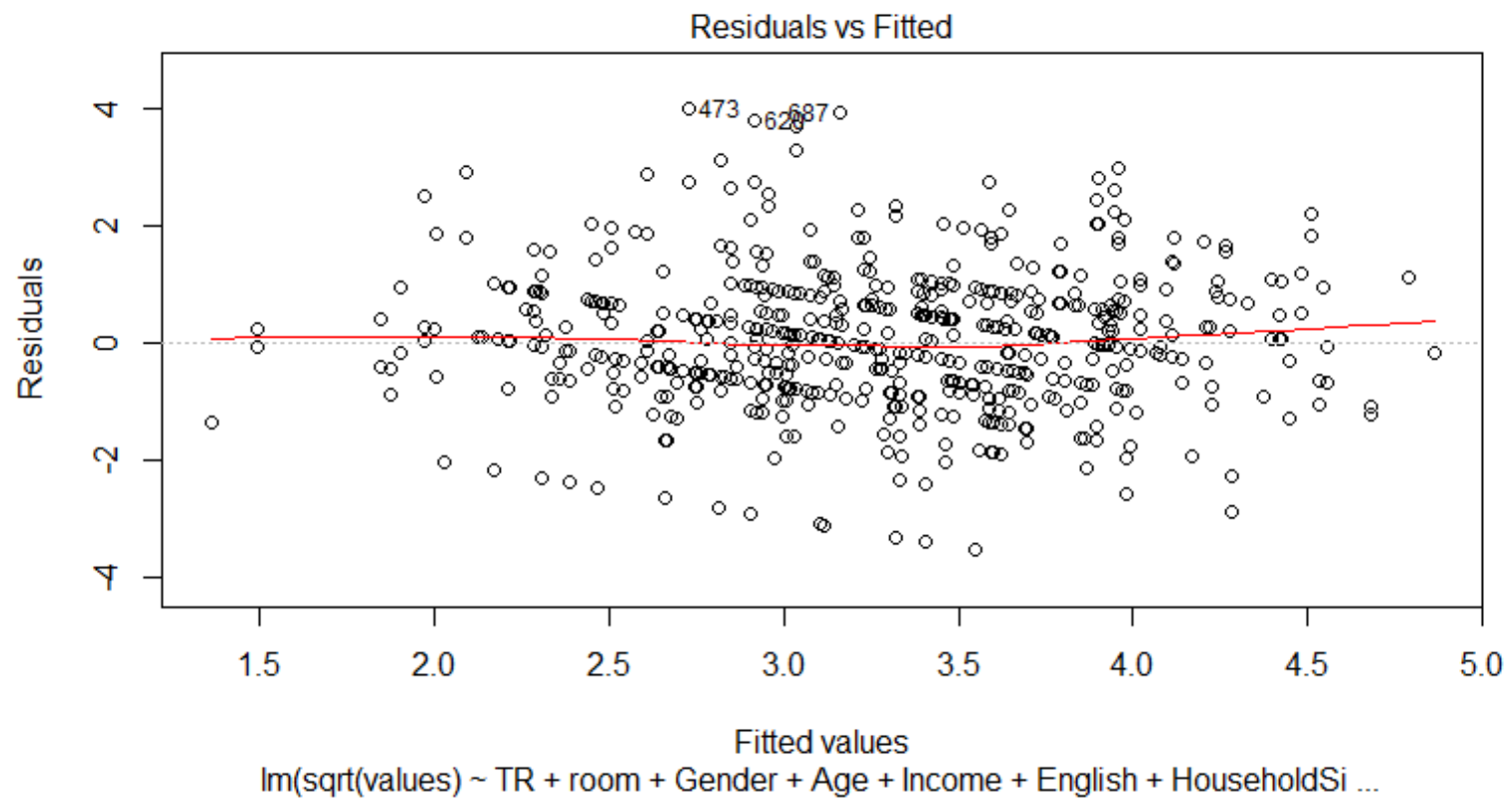
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Call:
lm(formula = sqrt(values) ~ TR + room + Gender + Age + Income +
    English + HouseholdSize, data = d.ragi.stack)

Residuals:
    Min       1Q   Median       3Q      Max
-3.5452 -0.7507  0.0211  0.7207  3.9794

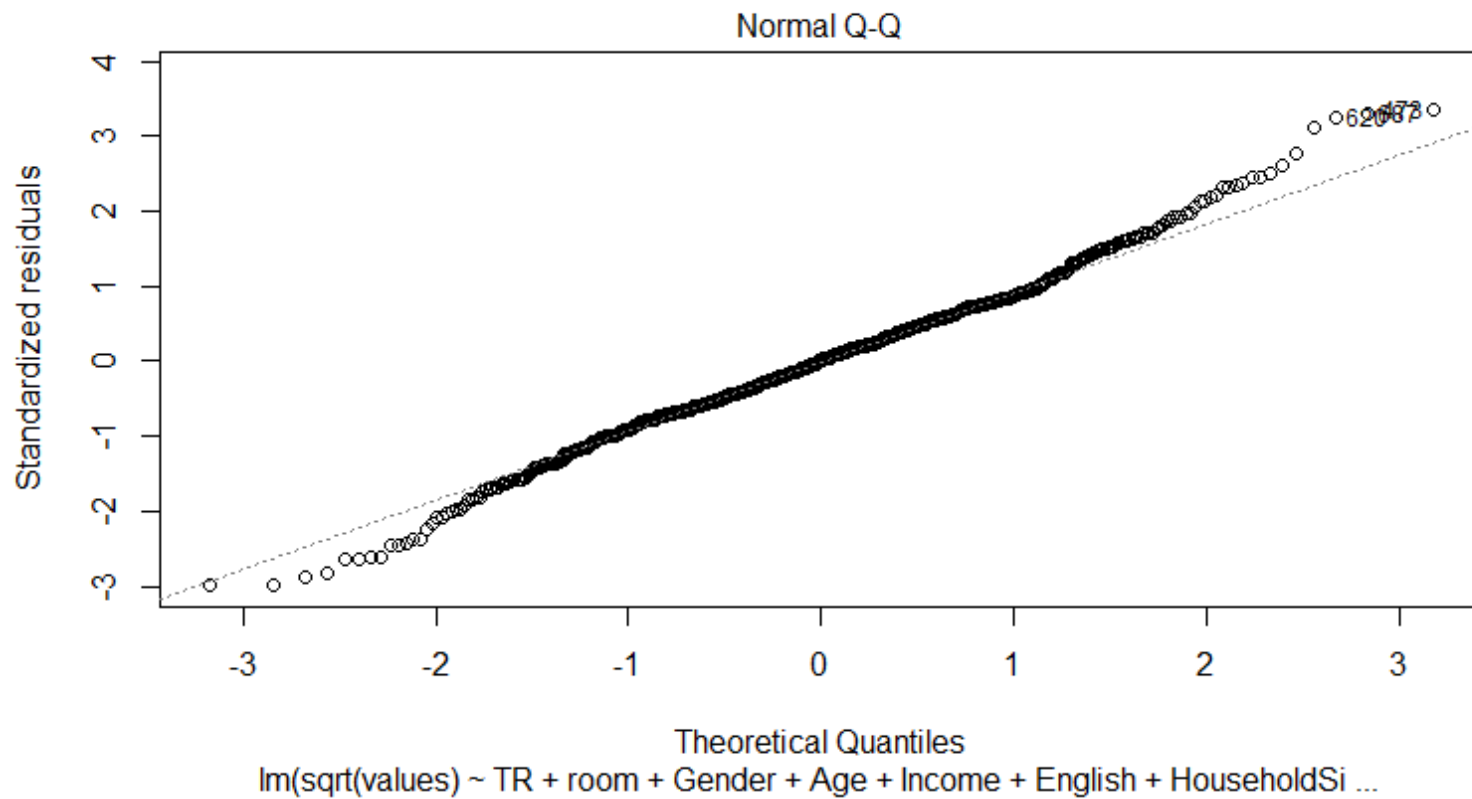
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.283093   0.349723  12.247 < 2e-16 ***
TR2            0.638548   0.112938   5.654 2.34e-08 ***
TR3            0.945087   0.112938   8.368 3.52e-16 ***
room2         -0.271964   0.101926  -2.668 0.007813 **
Gender1        0.084163   0.101975   0.825 0.409485
Age           -0.024892   0.004592  -5.421 8.35e-08 ***
Income2        0.427925   0.205892   2.078 0.038060 *
Income3        0.730793   0.204006   3.582 0.000366 ***
Income4        0.725858   0.233668   3.106 0.001976 **
Income5        0.739264   0.254277   2.907 0.003768 **
Income6        1.499571   0.226035   6.634 6.82e-11 ***
English2       -0.506215   0.128065  -3.953 8.56e-05 ***
English3       -0.629699   0.151143  -4.166 3.51e-05 ***
HouseholdSize -0.171047   0.035077  -4.876 1.36e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.194 on 657 degrees of freedom
(49 observations deleted due to missingness)
Multiple R-squared:  0.2182,    Adjusted R-squared:  0.2027
F-statistic: 14.1 on 13 and 657 DF,  p-value: < 2.2e-16
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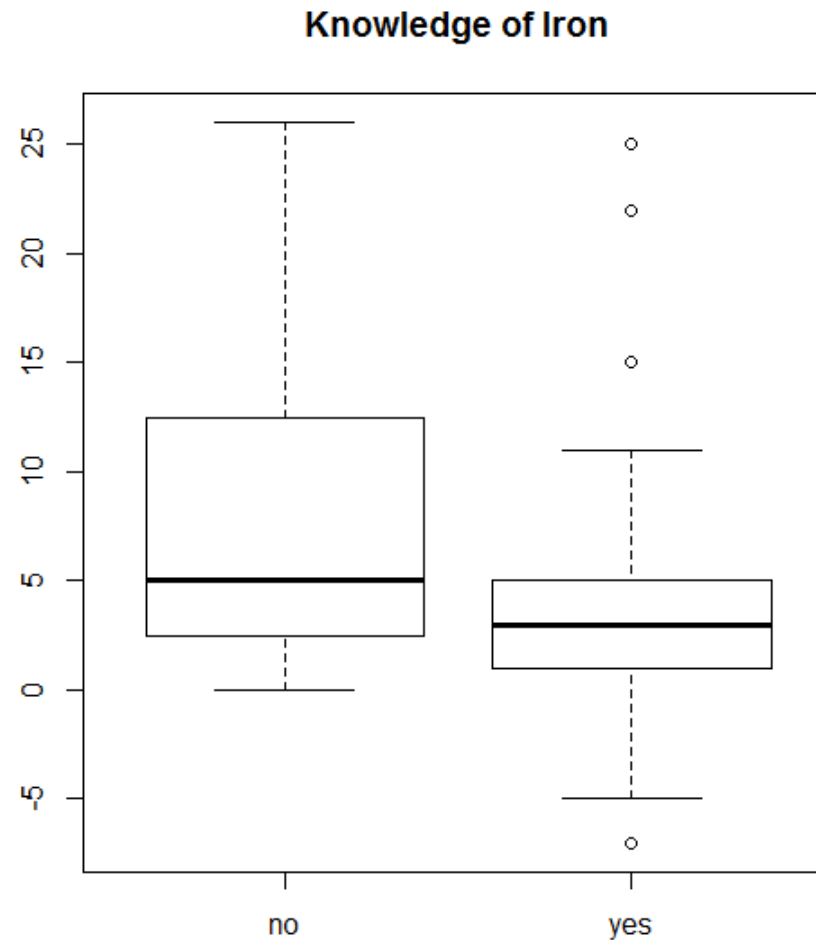
Regression results



Regression results



Increase in WTP (in Rupees) from R2 to R4 according to knowledge on iron



Increase in WTP (in Rupees) from R2 to R4 according to knowledge of health benefits of iron

