Table S1. *Comparison of baseline characteristics between intervention and delayed intervention groups in SNAP-Tz shows that randomization held for most variables besides being Muslim and income allocation decision-making power: January 2016, n=548*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Control (N=275) | |  | Intervention (N=273) | |  |  |
|  | *n* or mean | % or sd |  | *n* or mean | % or sd |  | p-value |
| **Key Outcomes** |  |  |  |  |  |  |  |
| Probable Depression (CES-Da >17) | 88 | 32.00 |  | 87 | 31.87 |  | 0.97 |
| Household Food Insecurity Access Scale (0-27) | 13.58 | 7.78 |  | 13.91 | 8.09 |  | 0.63 |
| Household Food Insecurityb |  |  |  |  |  |  | 0.63 |
| Food secure | 20 | 7.27 |  | 25 | 9.16 |  |  |
| Mild food insecurity | 16 | 5.82 |  | 12 | 4.40 |  |  |
| Moderate food insecurity | 12 | 4.36 |  | 8 | 2.93 |  |  |
| Severe food insecurity | 227 | 82.55 |  | 228 | 83.52 |  |  |
| **Sociodemographics** |  |  |  |  |  |  |  |
| Pregnant | 0 | 0.00 |  | 0 | 0.00 |  | -- |
| Farming as main occupation (ref: any other) | 270 | 98.55 |  | 267 | 97.80 |  | 0.52 |
| Monogamous marital status (ref: polygamous) | 251 | 91.27 |  | 251 | 91.94 |  | 0.78 |
| Nyaturu ethnic group (ref: other) | 266 | 96.73 |  | 261 | 95.60 |  | 0.49 |
| Muslim (ref: Christian, Traditional African, none) | 190 | 69.09 |  | 212 | 77.66 |  | 0.02\* |
| Wealth Tertilesc |  |  |  |  |  |  | 0.45 |
| Poorest | 94 | 34.18 |  | 80 | 29.30 |  |  |
| Middle | 93 | 33.82 |  | 96 | 35.16 |  |  |
| Wealthiest | 88 | 32.00 |  | 97 | 35.53 |  |  |
| Dependency Ratiod† | 1.50 | 0.75-2.00 |  | 1.25 | 0.75-2.00 |  | 0.35 |
| Age (years) | 29.78 | 7.19 |  | 29.94 | 7.84 |  | 0.35 |
| Years of education | 6.89 | 2.68 |  | 6.82 | 3.11 |  | 0.09 |
| Years lived in village | 7.73 | 7.49 |  | 8.04 | 8.25 |  | 0.67 |
| Adequate social support (≥3 out of 4)e | 227 | 82.55 |  | 210 | 76.92 |  | 0.10 |
| **Gender equity** |  |  |  |  |  |  |  |
| Experienced any domestic violencef | 69 | 25.09 |  | 78 | 28.57 |  | 0.42 |
| Attitude towards domestic violence (0-7)g† | 5.00 | 2.00-7.00 |  | 5.00 | 2.00-7.00 |  | 0.92 |
| Leisure time (hours) | 2.02 | 1.88 |  | 1.84 | 1.81 |  | 0.25 |
| Agricultural decision-making power (0-1)h† | 0.33 | 0.19-0.50 |  | 0.31 | 0.19-0.50 |  | 0.89 |
| Income allocation decision-making power (0-1)h† | 0.38 | 0.25-0.46 |  | 0.33 | 0.19-0.47 |  | 0.89 |
| Low income allocation decision-making power (<0.4) | 161 | 58.54 |  | 176 | 64.46 |  | 0.04\* |
| Men’s involvement with household chores (0-1) | 0.37 | 0.28 |  | 0.39 | 0.29 |  | 0.50 |

aCES-D: Center for Epidemiologic Studies Depression Scale(1); bcategories from Coates, Swindale & Bilinsky(2); cWealth tertile is based on asset index score, developed using principal component analysis from household’s ownerships of any land, metal roof, electricity, ox plow, solar panels, cell phone, radio, modern beds, mosquito net, books, bicycle, and cattle; ddependency ratio calculated as number of children (<14y) and elders (>65y)/number of household members between the ages of 15 and 64y; ecutoff from Antelman et. al.(3); fin past year; gWorld Bank indicator(4);  hmodified Women’s Empowerment in Agriculture Index(5).

\* p<0.05, †median (IQR) for non-normally distributed continuous variables.

Table S2. *Proportion of missing baseline information in SNAP-Tz is low (0-5%): January 2016, n=548*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Total | Missing |  | % Missing |
| **Key Outcomes** |  |  |  |  |
| Probable Depression (CES-Da >17) | 548 | 0 |  | 0.00 |
| Household Food Insecurity Access Scale (0-27) | 548 | 0 |  | 0.00 |
| **Sociodemographics** |  |  |  |  |
| Pregnant | 548 | 15 |  | 2.74 |
| Farming as main occupation | 548 | 1 |  | 0.18 |
| Monogamous marital status | 548 | 0 |  | 0.00 |
| Nyaturu ethnic group | 548 | 0 |  | 0.00 |
| Muslim | 548 | 0 |  | 0.00 |
| Wealth Tertilesb | 548 | 0 |  | 0.00 |
| Poorest |  | 0 |  | 0.00 |
| Middle |  | 0 |  | 0.00 |
| Wealthiest |  | 0 |  | 0.00 |
| Dependency Ratioc | 548 | 0 |  | 0.00 |
| Age (years) | 548 | 1 |  | 0.18 |
| Years of education | 548 | 1 |  | 0.18 |
| Years lived in village | 548 | 10 |  | 1.82 |
| Adequate social support (≥3 out of 4)d | 548 | 4 |  | 0.73 |
| **Gender equity** |  |  |  |  |
| Experienced any domestic violencee | 548 | 0 |  | 0.00 |
| Attitude towards domestic violence (0-7)f | 548 | 0 |  | 0.00 |
| Leisure time (hours) | 548 | 7 |  | 1.28 |
| Agricultural decision-making power (0-1)g | 548 | 0 |  | 0.00 |
| Income allocation decision-making power (0-1)g | 548 | 30 |  | 5.47 |
| Low income allocation decision-making power (<0.4) | 548 | 0 |  | 0.00 |
| Men’s involvement with household chores (0-1) | 548 | 0 |  | 0.00 |

aCES-D: Center for Epidemiologic Studies Depression Scale(1); bWealth tertile is based on asset index score, developed using principal component analysis from household’s ownerships of any land, metal roof, electricity, ox plow, solar panels, cell phone, radio, modern beds, mosquito net, books, bicycle, and cattle; cdependency ratio calculated as number of children (<14) and elders (>65)/number of household members between the ages of 15 and 64y; dcutoff from Antelman et. al.(3); ein past year; fWorld Bank indicator(4);  gmodified Women’s Empowerment in Agriculture Index(5).

Table S3. *Missingness of variables included in mediation analyses across 2016-2019 ranges from 0-20%, with more missing data in later years: SNAP-Tz, n=548*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Total | Missing |  | % Missing |
| Probable Depression (CES-Da>17) |  |  |  |  |
| 1b | 548 | 31 |  | 5.66 |
| 2 | 548 | 61 |  | 11.13 |
| 3 | 548 | 70 |  | 12.77 |
| Household Food Insecurity Access Scale (0-27) |  |  |  |  |
| 1 | 548 | 31 |  | 5.66 |
| 2 | 548 | 62 |  | 11.31 |
| 3 | 548 | 58 |  | 10.58 |
| Adequate social support (≥3 out of 4)c |  |  |  |  |
| 0 | 548 | 4 |  | 0.73 |
| 1 | 548 | 31 |  | 5.66 |
| 2 | 548 | 64 |  | 11.68 |
| Experienced any domestic violenced |  |  |  |  |
| 0 | 548 | 0 |  | 0.00 |
| 1 | 548 | 31 |  | 5.66 |
| 2 | 548 | 61 |  | 11.13 |
| Income allocation decision-making power (0-1)e |  |  |  |  |
| 0 | 548 | 30 |  | 5.47 |
| 1 | 548 | 32 |  | 5.84 |
| 2 | 548 | 64 |  | 11.68 |
| Men’s involvement with household chores (0-1) |  |  |  |  |
| 0 | 548 | 0 |  | 0.00 |
| 1 | 548 | 31 |  | 5.66 |
| 2 | 548 | 66 |  | 12.04 |

aCES-D: Center for Epidemiologic Studies Depression Scale(1);b0,1,2,3 refer to time points used for mediation analyses: 0=2016, 1=2017, 2=2018, 3=2019; cAntelman et. al.(3); din past year; emodified Women’s Empowerment in Agriculture Index(5).

Table S4. *Attrition from SNAP-Tz from 2017-2019, by baseline characteristics among participants (n=548). Attrition was significantly different by ethnic group, age, and years resident in village, such that these characteristics were included in the imputation models.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2017 | | | | | 2018 | | | | | 2019 | | | | |
|  | **Present (N=517)** | | **Missing (N=31)** | |  | **Present (N=489)** | | **Missing (N=59)** | |  | **Present (N=487)** | | **Missing (N=69)** | |  |
|  | *n* or mean | % or sd | *n* or mean | % or sd | p-value | *n* or mean | % or sd | *n* or mean | % or sd | p-value | *n* or mean | % or sd | *n* or mean | % or sd | p-value |
| Intervention | 257 | 49.71 | 16 | 51.61 | 0.84 | 241 | 49.28 | 32 | 54.24 | 0.47 | 236 | 48.54 | 40 | 58.57 | 0.12 |
| **Key Outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Probable Depression (CES-Da >17) | 163 | 31.53 | 12 | 38.71 | 0.40 | 158 | 32.31 | 17 | 28.81 | 0.59 | 157 | 32.85 | 18 | 25.71 | 0.98 |
| Household Food Insecurity Access Scale (0-27) | 13.86 | 7.88 | 11.71 | 8.56 | 0.14 | 13.85 | 7.85 | 12.85 | 8.57 | 0.36 | 13.94 | 7.91 | 12.39 | 7.95 | 0.13 |
| **Sociodemographics** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Farming as main occupation (ref: any other) | 508 | 98.26 | 30 | 96.77 | 0.55 | 481 | 98.36 | 57 | 96.61 | 0.34 | 470 | 98.33 | 68 | 97.14 | 0.49 |
| Monogamous marital status (ref: polygamous) | 471 | 91.10 | 31 | 100.00 | 0.08 | 449 | 91.82 | 53 | 89.83 | 0.60 | 438 | 91.63 | 40 | 91.43 | 0.95 |
| Nyaturu ethnic group (ref: other) | 500 | 96.71 | 27 | 87.10 | <0.01\* | 474 | 96.93 | 53 | 89.83 | <0.01\* | 463 | 96.86 | 64 | 91.43 | 0.03\* |
| Muslim (ref: Christian, Traditional African, none) | 382 | 73.89 | 20 | 64.52 | 0.25 | 360 | 73.62 | 42 | 71.19 | 0.69 | 350 | 73.22 | 52 | 74.29 | 0.85 |
| Wealth Tertilesb |  |  |  |  | 0.02\* |  |  |  |  | 0.33 |  |  |  |  | 0.97 |
| Poorest | 164 | 31.72 | 10 | 32.26 |  | 154 | 31.49 | 20 | 33.90 |  | 151 | 31.59 | 23 | 32.86 |  |
| Middle | 172 | 33.27 | 17 | 54.84 |  | 165 | 33.74 | 24 | 40.68 |  | 165 | 34.52 | 24 | 34.29 |  |
| Wealthiest | 181 | 35.01 | 4 | 12.90 |  | 170 | 34.76 | 15 | 25.42 |  | 162 | 33.89 | 23 | 32.86 |  |
| Dependency Ratioc† | 1.33 | 0.80-2.00 | 1.00 | 0.50-1.50 | 0.12 | 1.50 | 0.80-2.00 | 1.00 | 0.50-2.00 | 0.25 | 1.50 | 0.80-2.00 | 1.00 | 0.50-2.00 | 0.14 |
| Age (years) | 30.12 | 7.50 | 25.58 | 6.38 | <0.01\* | 30.11 | 7.50 | 27.81 | 7.33 | 0.03\* | 30.35 | 7.49 | 26.53 | 6.80 | <0.01\* |
| Years of education | 7.41 | 7.29 | 6.10 | 3.10 | 0.32 | 7.44 | 7.46 | 6.47 | 3.07 | 0.33 | 7.44 | 7.52 | 6.60 | 3.26 | 0.36 |
| Years lived in village | 8.07 | 7.97 | 4.68 | 5.22 | 0.02\* | 8.16 | 7.96 | 5.61 | 6.70 | 0.02\* | 8.30 | 8.07 | 5.04 | 5.60 | <0.01\* |
| Adequate social support (≥3 out of 4)d | 409 | 79.11 | 28 | 90.32 | 0.13 | 383 | 78.32 | 54 | 91.53 | 0.02\* | 376 | 78.66 | 61 | 87.14 | 0.10 |
| **Gender Equity** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Experienced any domestic violencee | 140 | 27.08 | 7 | 22.58 | 0.58 | 133 | 27.20 | 14 | 23.73 | 0.57 | 127 | 26.57 | 20 | 28.57 | 0.72 |
| Attitude towards domestic violence (0-7)f† | 5.00 | 2.0-7.00 | 2.00 | 0.00-7.00 | 0.12 | 5.00 | 2.00-7.00 | 5.0 | 1.00-6.00 | 0.21 | 5.00 | 2.00-7.00 | 4.00 | 1.00-6.00 | 0.28 |
| Leisure time (hours/day) | 1.92 | 1.86 | 2.10 | 1.76 | 0.60 | 1.91 | 1.87 | 2.15 | 1.72 | 0.35 | 1.90 | 1.84 | 2.13 | 1.90 | 0.34 |
| Agricultural decision-making power (0-1)g† | 0.33 | 0.19-0.50 | 0.31 | 0.19-0.50 | 0.75 | 0.31 | 0.19-0.50 | 0.31 | 0.25-0.50 | 0.45 | 0.31 | 0.17-0.50 | 0.32 | 0.25-0.50 | 0.35 |
| Income allocation decision-making power (0-1)g† | 0.36 | 0.19-0.50 | 0.31 | 0.17-0.44 | 0.30 | 0.36 | 0.21-0.47 | 0.34 | 0.19-0.50 | 0.76 | 0.36 | 0.21-0.47 | 0.35 | 0.25-0.50 | 0.91 |
| Men’s involvement with household chores (0-1) | 0.38 | 0.29 | 0.33 | 0.28 | 0.36 | 0.39 | 0.28 | 0.32 | 0.33 | 0.08 | 0.38 | 0.28 | 0.37 | 0.33 | 0.84 |

aCES-D: Center for Epidemiologic Studies Depression Scale(1); bWealthtertile is based on asset index score, developed using principal component analysis from household’s ownerships of any land, metal roof, electricity, ox plow, solar panels, cell phone, radio, modern beds, mosquito net, books, bicycle, and cattle;; cdependency ratio calculated as number of children (<14) and elders (>65)/number of household members between the ages of 15 and 64y; dcutoff from Antelman et. al.(3); eover past year; fWorld Bank indicator(4); gmodified Women’s Empowerment in Agriculture Index(5). \*p<0.05; †median (IQR) for non-normally distributed continuous variables.

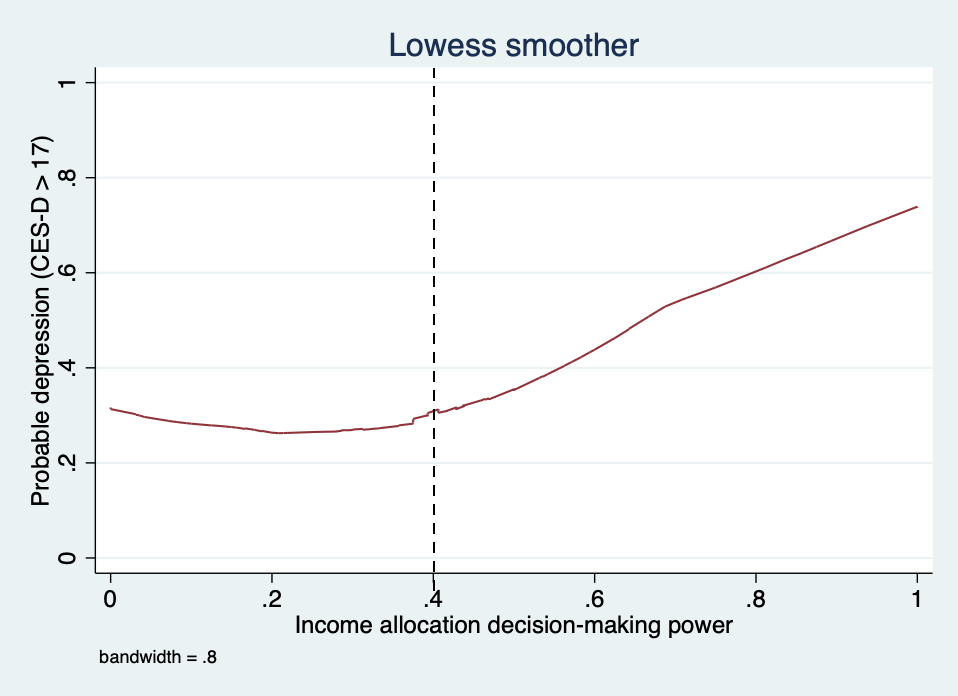


Figure S1. *Lowess smoothing graph of the association between probable depression (0 or 1) and low (0-0.4) vs high (0.4-1) income allocation decision-making power scores at baseline of SNAP-Tz (January 2016),* n=548. A linear relationship is apparent only among women with higher income allocation decision-making scores.

Table S5. The risk of probable depression (CES-D > 17) at baseline of SNAP-Tz (January 2016), in bivariate and multivariate models. Food insecurity, domestic violence experience, men’s involvement with household chores typically done by women, and higher income allocation decision-making power are significantly associated with greater likelihood of probable depression among smallholder farmers in Tanzania in multivariable regression when modeled as a continuous variable: [n=548]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Univariable β | 95% CI | Multivariable β | 95% CI |
| Intervention | 0.58 | (-1.48, 2.64) | -- | -- |
| **Key Outcome Variable** |  |  |  |  |
| Household Food Insecurity Access Scale score (0-27) | 0.61\*\* | (0.46, 0.76) | 0.54\*\* | (0.40, 0.67) |
| **Sociodemographics** |  |  |  |  |
| Farming as main occupation (ref: any other) | -1.37 | (-5.26, 2.53) | -- | -- |
| Monogamous marital status (ref: polygamous) | 3.85\* | (0.34, 7.36) | -- | -- |
| Nyaturu ethnic group (ref: other) | -1.85 | (-9.11, 5.42) | -- | -- |
| Muslim (ref: Christian, Traditional African, none) | -0.27 | (-2.6, 2.05) | -- | -- |
| Wealth Tertilesa |  |  |  |  |
| Poorest | Ref | -- | -- | -- |
| Middle | -1.81 | (-4.07, 0.45) | -- | -- |
| Wealthiest | -1.16 | (-3.94, 1.61) | -- | -- |
| Dependency Ratiob | 0.03 | (-0.03, 0.09) | -- | -- |
| Age (years) | 0.17\* | (0.03, 0.32) | -- | -- |
| Years of education | -0.01 | (-0.15, 0.13) | -- | -- |
| Years lived in village | 0.12 | (-0.002, 0.24) | -- | -- |
| Adequate social support (≥3 out of 4)c | -1.42 | (-4.03, 1.18) | -1.79 | (-3.97, 0.58) |
| **Gender equity** |  |  |  |  |
| Experienced any domestic violenced | 7.27\*\* | (5.03, 9.50) | 5.06\*\* | (2.75, 7.36) |
| Attitude towards domestic violence (0-7)e | 0.57\*\* | (0.18, 0.96) | -- | -- |
| Leisure time (hours) | -0.12 | (-0.82, 0.57) | -- | -- |
| Agricultural decision-making power (0-1)f | 5.49\* | (0.30, 10.67) | -- | -- |
| Income allocation decision-making power (0-1)f | 4.91\* | (0.06, 9.76) | **--** | -- |
| Income allocation decision-making power (0-0.4] | -6.55 | (-16.78, 3.67) | -- | -- |
| Income allocation decision-making power (0.4-1) | 17.67\*\* | (8.71, 26.63) | 7.78\* | (0.25, 15.32) |
| Men’s involvement with household chores (0-1) | -7.02\*\* | (-10.28, -3.76) | -3.42\* | (-6.33, -0.51) |

aWealth tertile is based on asset index score, developed using principal component analysis from household’s ownerships of any land, metal roof, electricity, ox plow, solar panels, cell phone, radio, modern beds, mosquito net, books, bicycle, and cattle; bDependency ratio is the number of children (<14 y) and elders (>65 y) divided by number of adult household members (15-64 y); ccutoff from Antelman et. al.(3); din past year; eWorld Bank indicator(4);  fmodified Women’s Empowerment in Agriculture Index(5). \* p<0.05, \*\*p<0.01.

Table S6. Sensitivity Analysis: Mediation coefficient comparisons between models with probable depression as a (a) binary and (b) continuous outcome and with (1) or without (2) income-allocation decision-making power as a confounder. All models demonstrate similar effects of food insecurity as a mediator of the intervention’s impact on probable depression: SNAP-Tz, January 2016 - January 2019, n=548

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Outcome = probable depression (CES-D > 17)* | | | | *Outcome = CES-D scores* | | | |
|  | *1a* |  | *2a* | | *1b* | | *2b* | |
|  | *OR* | *95% CI* | *OR* | *95% CI* | *β* | *95% CI* | *β* | *95% CI* |
| Natural Indirect Effect Estimate | 0.90 | 0.83, 0.95 | 0.89 | 0.85, 0.94 | -0.52 | -0.75, -0.27 | -0.53 | -0.72, -0.28 |
| Natural Direct Effect Estimate | 0.63 | 0.47, 0.80 | 0.65 | 0.51, 0.81 | -1.92 | -2.52, -1.22 | -1.81 | -2.66, -1.30 |
| Total Effect Estimate | 0.57 | 0.43, 0.70 | 0.58 | 0.46, 0.76 | -2.50 | -2.98, -1.76 | -2.39 | -3.15, -1.94 |
| Controlled for: |  |  |  |  |  |  |  |  |
| Social Supporta | yes |  | yes |  | yes |  | yes |  |
| Experienced any domestic violenceb | yes |  | yes |  | yes |  | yes |  |
| Income allocation decision-making powerc | yes |  | no |  | yes |  | no |  |
| Men’s involvement with household chores | yes |  | yes |  | yes |  | yes |  |

*OR, odds ratio. CI, confidence interval. Β, regression coefficient.* acutoff from Antelman et. al.(3); bmodified Women’s Empowerment in Agriculture Index(5); cmodelled as with spline at knot=0.4.

***References***

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