

1 **Investigating the effects of microcredit on the food security of rural**
2 **households: Evidence from Zehak County, Iran**

3 **Alireza Sani Heidary¹, Mahmoud Daneshvar Kakhki^{1*}, Mahmoud Sabouhi Sabouni¹,**
4 **and Hosein Mohammadi¹**

5
6 **Abstract**

7 Microcredit plays a vital role in rural households' food security. However, to the best of our
8 knowledge, the effects of microcredit on improving the food security of households have not
9 yet been well studied and understood in Iran. Thus, the purposes of this is to analyze the success
10 of microcredit programs on enhancing the food security of rural households in Zehak county
11 using the propensity score matching method and bootstrap algorithm. For this purpose, two
12 food security indices, including the Food Consumption Score (FCS) and the Household Food
13 Insecurity Access Scale (HFIAS) are used. The results revealed that 100% of the households
14 face food insecurity. The prevalence of food insecurity was 20.0%, 42.5%, and 37.5% for mild,
15 moderate, and severe food insecurity, respectively. In addition, 30% of households are in poor
16 status of food consumption. Our findings emphasize the positive and significant role of
17 microcredit in improving food security. The findings demonstrated that microcredit decreased
18 the HFIAS index of the recipient households by 24.31-27.81% and increased the FCS index by
19 25.87-31.45%. Therefore, policy-makers and decision-makers should promote and strengthen
20 governmental and non-governmental organizations providing microcredit. It is also
21 recommended to provide information and reduce collateral restrictions to increase households'
22 access to microcredit.

23 **Keywords:** Propensity score matching, Bootstrap algorithm, Food security, Microcredit

24
25 **1. Introduction**

26 Since food security is important for human well-being, its realization is one of the most
27 important goals of development plans at the national and international levels (World Bank,
28 2008; Dehbidi et al., 2022; Bahiru et al., 2023). Food security means that all people can obtain
29 sufficient, safe, and nutritious food materially and economically at any time to meet their
30 dietary needs and food preferences and live an active and healthy life. Therefore, food
31 availability, food accessibility, food utilization, and stability over time are four important
32 components to food security (Dehbidi et al., 2022).

¹ Department of Agricultural Economics, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Islamic Republic of Iran.

* Corresponding author; e-mail: daneshvar@um.ac.ir

33 Food insecurity is one of the major global problems in the last two decades, especially
34 developing countries. Food security is affected by climate change and extremes (Schillerberg
35 and Tian, 2023; Kandel et al., 2024), resource consumption (Chowdhury et al., 2017; Liu et
36 al., 2020), land degradation (Gomiero, 2016), population growth (Liu et al., 2020), and
37 urbanization (Boltana et al., 2023). Among them, climate change seems to have a significant
38 impact on activities related to food security in agriculture-dependent countries. The agricultural
39 sector plays a vital role in food supply, i.e., food production, strongly influenced by climate
40 variability (Ghalibaf et al., 2023). For this reason, the destructive effects of climate change are
41 greater for the rural community and lead to an increase in food insecurity. In the long term, the
42 adverse effects of climate change and other factors will pose major challenges to the nutrition
43 and food security of rural communities (Ehtesham Majd et al., 2019; Salman et al., 2023).

44 Therefore, ensuring food security, especially in vulnerable rural areas, requires changing
45 systems through government institutions, regional development institutions, and non-
46 governmental organizations (Boltana et al., 2023). In this regard, microcredit is one of the key
47 measures proposed to reduce food insecurity (Salima et al., 2023).

48 Microcredit is a form of microloans that are granted to poor rural households who usually lack
49 collateral, verifiable credit history, and steady employment. In addition, they are micro-loans
50 specifically intended for the creation and development of income-generating rural businesses.

51 Microcredit has a high potential to enhance food security, improve living standards, and reduce
52 poverty by supporting entrepreneurship and creating income-generating activities (Bakare et
53 al., 2023).

54 In Iran, a new approach to microfinance was developed by the United Nations International
55 Fund for Agricultural Development to provide access to formal and informal loans for the poor
56 and low-income rural groups to create and develop rural businesses, empower them to cope
57 with many shocks, improve livelihoods and food security, reduce vulnerability, and break out
58 of the cycle of poverty. These programs have great potential to improve household food
59 security by diversifying rural income-generating activities (Akbari and Danaie, 2018).

60 As a developing country, Iran faces the challenge of food insecurity, particularly in rural
61 areas. Based on FAO, IFAD, UNICEF, WFP, and WHO (2022), 42.4% of Iran's
62 population is affected by moderate or severe food insecurity. For this reason, ensuring food
63 security has become one of the most important goals of Iran's national development plans in
64 the last two decades. In this regard, various measures have been taken to improve rural
65 households' food security, of which microcredit is one of the most important.

66 However, few studies investigated the effects of microcredit on household food security. These
67 studies are divided into three groups. First, most of the studies revealed that microcredit
68 increases the per capita consumption of calories, increases the number of meals and increases
69 the access to food, which results in improving the food security of households (Islam et al.,
70 2016; Devereux, 2016; Berhanu et al., 2021; Boltana et al., 2023), particularly female-headed
71 households (Hamad and Fernald, 2012; Bocher et al., 2017; Haque, 2021; Kianersi et al., 2021;
72 Wongnaa et al., 2023). Second, a small number of studies did not find a significant effect of
73 the role of microcredit on improving households' food security, and they stated that receiving
74 credit was not successful in improving households' food security (Banerjee et al., 2016; Seng,
75 2018; Mahmud et al., 2022; Salima et al., 2023). Third, a limited number of studies showed
76 that excessive debt, loan repayment pressure, women's lack of control over the use of loans,
77 and frequent loans with high-interest rates lead to food insecurity in households, especially
78 with female heads (Ahmed et al., 2001; Develtere and Huybrechts, 2005; Aromolaran, 2010;
79 Ganle et al., 2015; Namayengo et al., 2018).

80 In general, this study can contribute to the literature on the effects of microfinance programs
81 on improving household food security in three ways. First, this study investigates the effects
82 of implementing an effective economic program (such as microcredit) on reducing household
83 vulnerability to food insecurity. Considering household food security is subject to change, it is
84 necessary to examine the effects of food security improvement programs such as microcredit
85 to predict future shocks and understand how households respond to food insecurity. Second,
86 this study can help to understand why microcredit has positive and negative effects in different
87 situations or times by generating empirical evidence and documenting the evaluation of its
88 effects. Third, given that studies show that there is no consensus or global pattern on the effects
89 of microcredit and that it can be beneficial or harmful, local policy-makers and decision-makers
90 must see evidence of the effects of its implementation in a specific region. In this regard, this
91 study can help local policy-makers gain a clearer picture and better understanding of the effects
92 of implementing microcredit programs on improving the food security of rural households and
93 take them into account when defining and changing their policies and programs.

94 Therefore, this study seeks to answer three key questions. First, what is the food security
95 situation of the target rural households? Second, what factors influence the access of target
96 households to microcredit? Third, has the microcredit program improved the food security of
97 the target households?

98

99 **2. Materials and methods**

100 *2.1. Study area and data*

101 Zehak County is a poor county, which is located in the north of Sistan and Baluchestan
102 Province and consists of two districts: Central and Jazinak, and four rural districts: Zehak,
103 Khajeh-Ahmad, Jazinak, and Khamak (Figure 1). There are 20,055 households in this county,
104 of which 16,817 are rural (Statistical Center of Iran, 2016). Rural households in Zehak face
105 problems such as lack of financial resources, poverty, high vulnerability, and food insecurity.
106 In addition, this county suffers from climatic events such as drought, excessive heat, low
107 rainfall, and 120-day winds. Considering the high poverty and deprivation in this county,
108 climate disasters have increased the vulnerability and food insecurity of households,
109 particularly rural ones. The food security situation of rural households in this county indicates
110 that a high proportion of households are in a state of food insecurity and use the most difficult
111 strategies to cope with this situation (Okati et al., 2020). According to the document on
112 economic development and employment generation in rural areas of Sistan and Baluchestan
113 Province, one of the effective measures to reduce household vulnerability, create employment,
114 improve food security, and diversify economic and production activities is to support the
115 establishment and development of microfinance funds to increase rural households' access to
116 microcredit (Ebrahimzadeh and Paidar, 2019). This county's most important organizations
117 providing microfinance services include the Agricultural Bank, the Welfare Organization and,
118 the Kara System (governmental organizations), the Barkat Foundation, and the Alavi
119 Foundation (non-governmental organizations). The total microcredit payments to rural
120 households from 1397 to 1400 was about 1459 billion rials, of which about 3 percent was paid
121 by government organizations and 97 percent by non-governmental organizations. Therefore,
122 conducting this study in the rural of Zehak County can be a suitable platform for evaluating the
123 performance of microcredit programs on rural households' food security for appropriate and
124 well-functioning local policymaking and planning.

125 To obtain the needed data the Stratified Random Sampling was applied. According to
126 Cochran's formula, the sample size was estimated to be 376 rural households. A
127 multidimensional questionnaire and semi-structured interview were used to obtain the
128 necessary data to calculate food security indicators, socio-economic, and demographic
129 characteristics, farm and livestock characteristics, and experiences of shocks.

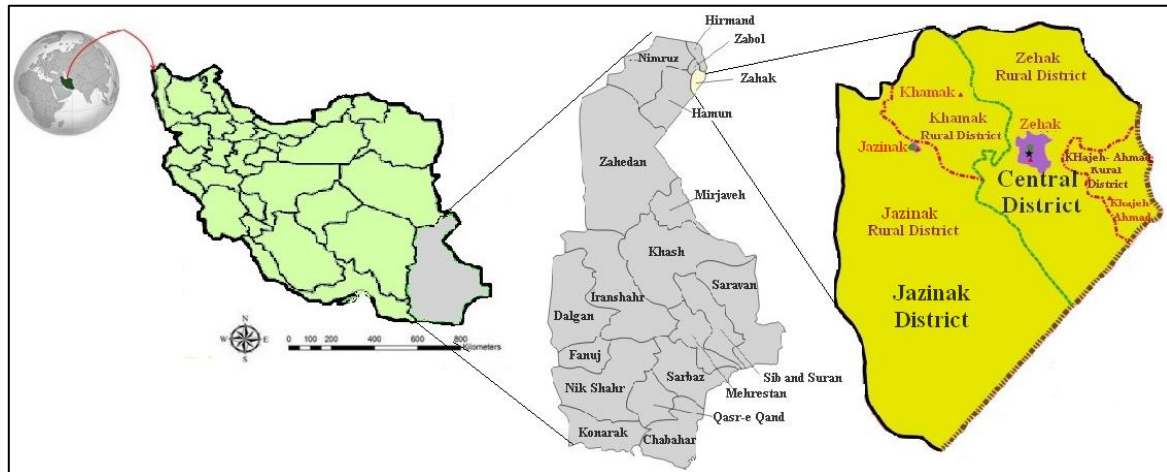


Fig. 1. Geographical location of the study area.

2.2. Food security index

Two food security indices, including the Household Food Insecurity Access Scale (HFIAS) and the Food Consumption Score (FCS), are used to understand households' food security status in this study. The HFIAS index was developed by the Food and Nutrition Technical Assistance II (FANTA) project between 2001 and 2006 (Coates et al., 2007; Salman et al., 2023). This index is measured based on a short questionnaire that determines the behavioral and psychological characteristics of households from access to food insecurity in 30 days (Kolog et al., 2023). The questionnaire consists of two types of questions: there are nine "occurrence" questions and nine "frequency of occurrence". The respondent is first asked whether he or she has experienced a certain situation (0= no, 1= yes) and if so, how often it has been experienced (1= rarely, 2= sometimes, 3= often). To calculate the HFIAS index, each of the nine questions (Q_{ia}) is given a score between 0 and 3, and finally the scores of all questions are summed together using equation (1). The calculated HFIAS score for each household ranges from 0 to 27, which indicates the degree of food insecurity experienced by households (Coates et al., 2007).

$$HFIAS_{score} = \sum Q_i a, \quad i = 1, 2, \dots, 9 \quad (1)$$

The HFIAS questionnaire provides information on the Domains and Prevalence of household food insecurity (Table A1).

The FCS index was developed by the World Food Programme (WFP) in 1996. This index measures diet quality and food intake (Baumann et al., 2013). The respondent reports the frequency of household consumption of 8 different food groups (X_i) (i.e., staple foods with a weight of 2, meat and fish with a weight of 4, fruit with a weight of 1, vegetables with a weight of 1, dairy products with a weight of 4, pulses with a weight of 3, oil with a weight of 0.5, and sugar with a weight of 0.5) during a 7-day reference period. The frequency of consumption of

155 each food group is multiplied by an assigned weight (α_i) for each group and the resulting
156 scores are summed to calculate the FCS using equation (2) (Jones et al., 2013):

$$FCS = \sum \alpha_i X_i, \quad i = (1, 2, \dots, 8) \quad (2)$$

157 The households are classified into three groups of food consumption: poor, borderline, and
158 acceptable. The maximum score for a household is 112. This score can only be reached if a
159 household consumes food from each food group every day (Baumann et al., 2013).

160

161 **2.3. Propensity Score Matching**

162 This study used the propensity score matching algorithms to investigate the effect of
163 microcredit on food security indices. This method is included in the group of methods for
164 assessing the impact of an action or policy on two groups, affected and unaffected. In other
165 words, PSM is an intuitive approach to estimating the effects of implementing an action or
166 policy, which broadly evaluates its success. This method has attracted the attention of
167 researchers to evaluate the effect of development programs such as microcredit on households'
168 food security and living standards (Berhanu et al., 2021; Mahmud et al., 2022; Boltana et al.,
169 2023; Wongnaa et al., 2023).

170 The PSM method is one of the methods that can eliminate the problem of selection bias due to
171 observed factors in the framework of observational data without functional and distributional
172 assumptions (Gitonga et al., 2013). This method is based on the assumption that selection bias
173 due to observed factors can be eliminated by matching each recipient household with one or
174 more non-recipient households that are similar in observable characteristics. The PSM method
175 identifies a causal relationship between microcredit receipt and outcome variables by
176 comparing the means between recipient households (treatment group) and non-recipient
177 households (control group) based on the Wilcoxon rank test (Gitonga et al., 2013; Luan and
178 Bauer, 2016). This method does not require time series data to evaluate the success of a policy
179 or action and can be estimated only with data from a single point in time (Sani Heidary et al.,
180 2020). One of the important limitations of PSM is that it cannot exploit selection bias caused
181 by unobserved factors (latent bias). In this regard, in the PSM method, the degree of sensitivity
182 of the results to latent bias should be determined using the sensitivity analysis proposed by
183 Rosenbaum (2002).

184 The matching method was conducted through two main stages to investigate the effect of
185 microcredit on food security. The first stage is to determine the factors influencing the
186 household decision to use microcredit using the logit model. This model is usually preferred

187 over the probit model for reasons such as a) simple interpretability of estimated coefficients;
 188 b) greater flexibility in fitting data; c) being resistant to outliers and providing more stable
 189 results (Greene, 2012).

190 A household may apply for microcredit based on its expected costs and benefits (Luan and
 191 Bauer, 2016; Boltana et al., 2023). The logit model can be written as follows:

$$192 \quad AMC_i^* = \beta X_i + \varepsilon_i, \quad \forall i = 1, 2, \dots, N \quad (3)$$

193 where, AMC_i^* is the microcredit status of the household. AMC_i equals one if the household
 194 took at least one microcredit in the previous 36 months and otherwise zero. X_i is a set of
 195 independent variables. ε_i is an error term following the normal distribution, and N is the
 196 number of households.

197 In the second step, recipients and non-recipients of microcredit were matched by their
 198 propensity scores using three matching estimators, including nearest neighbor, kernel, and
 199 radius matching. In the nearest neighbor method, each household in the control group is
 200 matched to the nearest household in the treatment group. $C(P_i)$ represents the set of households
 201 in the control group matched to households in the treatment group, which have propensity
 202 scores P_j and P_i , respectively. Therefore, the nearest neighbor matching algorithm is defined
 203 as follows (Becker and Ichino, 2002):

$$204 \quad C(P_i) = \min_j \|P_i - P_j\| \quad (4)$$

205 In the radius method, households in the control and treatment groups are matched within a
 206 certain distance of the propensity score of the treatment group household, P_i . Therefore,
 matching based on the radius method is defined as follows (Becker and Ichino, 2002):

$$207 \quad C(P_i) = \{P_j \mid \|P_i - P_j\| < r\} \quad (5)$$

208 In equation (5), all propensity scores of control group households are matched with unit i of
 the treatment group household at a distance r from p_i .

209 In core matching, each treatment group household is matched with a weighted average of each
 210 control group household that has a similar propensity score; but more weight is given to
 211 households with a closer propensity score. Assuming that T and C are the sets of treatment and
 212 control group households, respectively, and Y_iT and Y_jC are the observed outcomes for their
 213 groups, core matching algorithms are defined in standard terms as follows (Becker and Ichino,
 214 2002):

$$TK = \frac{\sum_{j \in C} Y_j^C G\left(\frac{p_j - p_i}{h_n}\right)}{\sum_{k \in C} G\left(\frac{p_k - p_i}{h_n}\right)} \quad (6)$$

215 The effect of microcredit on food security indices is estimated by the Average Treatment
216 Effects on the Treated (ATT), which is expressed as follows (Luan and Bauer, 2016; Boltana
217 et al., 2023):

$$218 \quad ATT = E(Y^1|D = 1) - E(Y^0|D = 1) \quad (7)$$

219 where, $E(Y^1 | D=1)$ and $E(Y^0 | D=1)$ denote outcomes for microcredit accessed households
220 and the hypothetical outcome that would have resulted if the accessed household had not taken
221 microcredit, respectively.

222 The degree of sensitivity of the results to the bias caused by unobserved factors was
223 investigated using the sensitivity analysis (Boltana et al., 2023).

224 This analysis can determine to what extent the existence of latent bias in the study will have no
225 effect on the results (Rosenbaum, 2002). The odds ratio of two identical households i and j to
226 receive the credit is defined as equation 8 (Guo and Fraser, 2014):

$$\frac{1}{\Gamma} \leq \frac{P_i(1-P_j)}{P_j(1-P_i)} \leq \Gamma \quad (8)$$

227 where, $P_i/(1-P_i)$ and $P_j/(1-P_j)$ represent the odds of households i and j receiving the credit, Γ
228 denotes the degree of a study's bias to latent bias. Sensitivity analysis at different values of Γ
229 examines how changes in Γ lead to changes in the outcome of the participation effect in
230 microcredit. A study is sensitive if values of Γ close to 1 can lead to very different inferences
231 from the obtained results (i.e., the probability level at $\Gamma=1$ is significant). If larger values of Γ
232 are required to change the inference, the study is insensitive (Guo and Fraser, 2014).

233 Additionally, the bootstrap algorithm was also used to improve the standard error of the PSM
234 method (Austin and Small, 2014).

235 3. Results and Discussion

237 3.1. Descriptive statistics

238 Table (1) provides the descriptive statistics of variables for microcredit recipients and non-
239 recipients. Of the 376 households' heads, 177 (47%) were microcredit recipients and 199 (53%)
240 were non-recipients. Compared to non-recipient households, microcredit recipients are
241 younger, more educated, have more people who can help them in times of crisis, have larger
242 families, have lower dependency ratios, have more social interactions (in terms of membership

243 in social groups and the number of visits to agricultural extension services), have a higher level
 244 of awareness and access to information about strategies for adapting to climate change, have
 245 greater access to local markets, and have lower savings. Recipient households have larger
 246 agricultural land compared to non-recipients. They have experienced more shocks and have
 247 consequently been more exposed to various shocks; therefore, they have suffered greater losses
 248 in agricultural and livestock products. These households are located at a shorter distance from
 249 microcredit disbursing institutions.

250 **Table 1.** Descriptive statistics of variables, measurements, and expected signs.

Variables	Measurement	Non-recipient	Recipient	Expected sign
Age of household heads	Years	63.784	53.243	+/-
Membership of the head of the household in social groups	Number	1.829	2.960	+
Education of household heads	Years	4.864	6.740	+
Household size	Persons	4.719	6.198	+
The number of people known who could be asked for help	Persons	13.890	19.158	+
The contacts with agricultural extension	Number	4.055	7.881	+
Saving	Million Rials(IRR)	18.658	13.073	-
Dependency ratio: The ratio of household members without income to household income earners	(%)	0.423	0.278	-
Total land size	Hectare	3.262	6.090	+
Experience of various natural shocks in the last three years	Number	10.302	11.616	+
Cropshock: The value of losses of agricultural products due to various shocks	Million Rials	98.719	118.446	+
Animals shock: Livestock lost due to various shocks	Number	4.025	6.616	+
Awareness of adaptation strategies	Quality: score from 1 to 3	1.714	2.678	+
Access to information on climate change	1=Yes; 0=No	0.428	0.718	+
Distance to the lending institution	Minutes	32.281	20.232	-
Access to the local market	1=Yes; 0=No	0.745	0.802	+
Number of observations		199	177	

251

252 3.2. Households' food security status

253 Table 2 provides the results of the HFIAS and FCS indices. Our findings show that 100% of the
 254 households experienced anxiety and uncertainty related to food insecurity. Also, approximately 94.7%
 255 of the households experienced insufficient and poor quality food, and about 80.0% suffered from
 256 insufficient food intake and its physical consequences. In addition, the results reveal that 100% of the
 257 households are food insecure, which 37.5% of them are in severe food insecure. The results of the FCS
 258 index indicate that 44.1% and 30.1% of the total households are at borderline and poor food
 259 consumption levels, respectively. Table 3 presents the regional analysis of food security. The results
 260 show that food insecurity is more in the central district than Jazinak district. Among the rural districts,
 261 food insecurity is more severe in Zehak Rural District.

262 **Table 2.** Summary information on household food insecurity access (a) domains, (b)
263 prevalence, and FCS.

Index	Categories	Frequency	Percentage
HFIAD	Insufficient food intake and physical consequences	301	80
	Insufficient Quality	356	94.7
	Anxiety and uncertainty	376	100
HFIAP	severely food insecure	141	37.5
	moderately food insecure	160	42.5
	mildly food insecure	75	20
	food secure	0	0.0
FCS	Acceptable	97	26.8
	Borderline	166	44.1
	Poor	113	30.1

Source: research findings

264

265

Table 3. Summary of estimated values for HFIAS and FCS indices.

Region	Villages (Number)	Households (Number)	HFIAS	FCS
Central District	28	278	17.10	24.00
Zehak Rural District	20	212	17.80	23.00
Khajeh-Ahmad Rural District	8	66	16.30	25.00
Jazinak District	16	98	13.75	27.75
Khamak Rural District	9	53	13.30	28.50
Jazinak Rural District	7	45	14.20	27.00
Average scores of total observations	44	376	15.85	25.36
minimum scores of total observations	44	376	5.00	17.00
maximum scores of total observations	44	376	23.00	75.50

Source: research findings

266

267 3.3. Propensity score matching

268 Table 4 provides the logit model results. The findings reveal that a one percent increase in the
269 age of the head of the household decreases the probability of access to microcredit by 6.1%.
270 (Luan and Bauer, 2016; Sani Heidary et al., 2020), which showed that Older household heads
271 have less access to innovations and financial information. However, this finding contradicts
272 the results by Akotey & Adjasi (2016) for Ghana. A one percent increase in household savings
273 leads to decrease the probability of access to microcredit by 8.5%. Similarly, the studies by
274 Luan and Bauer (2016) in Vietnam and Sani Heidary et al. (2020) in Iran revealed that
275 household savings are used to invest in future productions and meet essential needs. A one
276 percent increase in the dependency ratio of households reduces the probability of their access
277 to microcredit by 0.330%. Households with more dependents are generally exposed to more
278 credit constraints. These findings is consistent to the results of Thanh et al. (2019) and
279 inconsistent with the results of Li et al. (2011). The probability of receiving microcredit by
280 households with high awareness of climate change adaptation strategies is 12.9% more than
281 households with low awareness. This result is consistent the findings of with previous research
282 (Luan and Bauer, 2016; Ojo et al., 2019), which indicated that microcredit is a critical tool for

283 improving adaptation strategies. However, our findings do not confirm the obtained results by
284 Bakare et al. (2023).

285 A one percent increase in the household head's education increases the probability of access to
286 microcredit by 1.4%. Similarly, the studies by Thanh et al. (2019) and Berhanu et al. (2021)
287 revealed that educated household heads are more willing to receive microcredit to reduce the
288 financial imbalance. The results reveal that a one percent increase in households' contacts with
289 agricultural extension institutions increases the probability of microcredit access by 2.1%. In
290 addition, a one percent increase in the number of helpers increases the probability of access of
291 microcredit by 9.5%. These findings are similar to previous research (Luan and Bauer, 2016;
292 Sani Heidary et al., 2020; Berhanu et al., 2021), which indicated that increasing the social
293 connections of households through their connections with institutions leads to an increase in
294 their information about important rural issues, particularly financial resources, and influences
295 their demand for access to credit. Additionally, increasing the number of people who can help
296 households in critical situations such as loan repayment leads to an increase in their demand
297 for credit and can even be considered as social guarantors of households for credit-paying
298 institutions. The results of these two variables emphasize the effective social communications
299 and interactions of households, which facilitate their access to necessary resources, particularly
300 credit.

301 A one percent increase in household size increases the probability of access to microcredit by
302 4.5%. The studies by Akotey and Adjasi (2016) in Ghana and Berhanu et al. (2021) in Ethiopia
303 revealed that larger households have sufficient labor force to participate in rural micro-
304 businesses, which increases the need for household credit to establish businesses. In addition,
305 larger households have greater food needs for sustainable consumption and, therefore, require
306 more financial resources for sustainable household food consumption, which microcredit can
307 meet.

308 A one percent increase in household farm size increases the probability of access to microcredit
309 by 5.1%. This result is consistent with previous studies (Luan and Bauer, 2016; Sani Heidary
310 et al., 2020) which demonstrated that access to larger agricultural land increases the use of key
311 inputs, which consequently increasing the need for capital and credit. A one percent increase
312 of losses in the production of agricultural products and loss in livestock populations, the
313 probability of households' access to microcredit increases by 1.3% and 2.3%, respectively. The
314 greater the losses caused by various shocks, the more households use microcredit as an
315 immediate tool to increase coping ability (Luan and Bauer, 2016; Berhanu et al., 2021).

Table 4. The results of logit model.

Variable		Coefficients (std. err)	Z-value	Marginal Effect
Age of household heads		-0.244 (0.118)	-2.07**	-0.061**
Saving		-0.339 (0.176)	-1.93**	-0.085**
Distance to the lending institution		-0.636 (0.772)	-0.82	-0.158
Dependency ratio		-1.326 (0.695)	-1.91**	-0.330**
Awareness of adaptation strategies	Medium	-0.196 (0.244)	-0.81	-0.049
	High	0.521 (0.241)	2.16**	0.129**
Education of household heads		0.055 (0.026)	2.15**	0.014**
The contacts with agricultural extension		0.084 (0.041)	2.03**	0.021**
The number of people known who could be asked for help		0.384 (0.151)	2.53**	0.095**
Household size		0.182 (0.085)	2.14**	0.045**
Total land size		0.205 (0.057)	3.59***	0.051***
Cropshock		0.049 (0.021)	2.31**	0.013**
Animalshock		0.094 (0.044)	2.13**	0.023**
Experience of various natural shocks		0.090 (0.096)	0.94	0.022
Membership in social groups		0.031 (0.082)	0.38	0.008
Access to information on climate change		0.488 (0.256)	1.90*	0.120*
Access to the local market		0.311 (0.293)	1.20	0.077
Intercept		-3.492 (1.615)	-2.16**	-
LR chi2(17)		100.80***		
Pseudo R2		0.194		
Correctly classified (%)		76.06		
Hosmer–Lemeshow chi2(8)		5.55		
Prob > Hosmer–Lemeshow chi2		0.236		
Number of observations (No Credit)		199		
Number of observations (Credit accessed)		177		
Number of observations (All sample)		376		

Notes: *** Significant at $P < 0.01$; ** Significant at $P < 0.05$; * Significant at $P < 0.05$.

317

318

319

320

321

322

323

324

The results show that the mean of bias decreased and covariates became insignificant after matching. The bias percentage of covariates after matching has been significantly reduced compared to before. (Figure 2). Visual inspection of propensity score distributions showed that the common support condition was met, indicating a high overlap between microcredit recipients and non-recipients (Figure 3). This shows that the matching of the two groups is appropriate and the PSM results are highly reliable. In Figure 3, “On support” refers to the

325 households that were present in the compliance of the two treatment and control groups, and
 326 “Off support” refers to the households that were not present in the compliance of the two
 327 treatment and control groups.

328

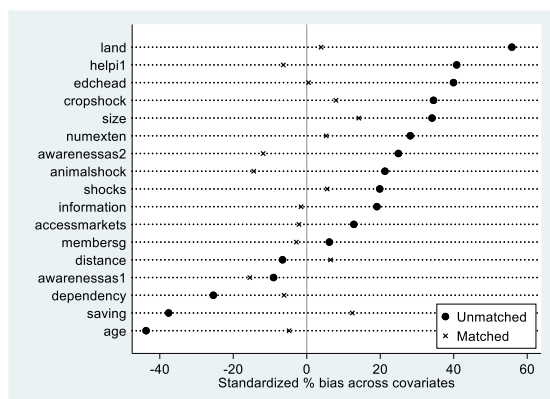


Fig. 2. Bias % of covariates before and after matching.

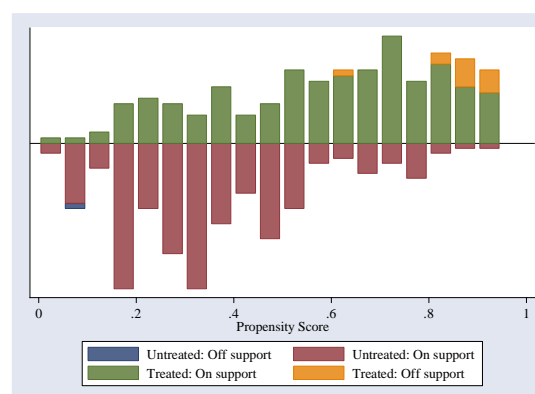


Fig. 3. The distribution of propensity scores (PS) and common support for estimating PS.

329

330 Table 5 provides the effects of microcredit on the HFIAS and FCS indices using three matching
 331 algorithms (nearest neighbor, kernel, and radius). The findings demonstrate that microcredit
 332 has a negative and significant effect on HFIAS for three matching estimators. Households
 333 receiving microcredit have lower food insecurity scores (9.80-9.99) than non-recipient
 334 households (12.95-13.83). Microcredit has reduced the HFIAS score by 24.3-27.8% for
 335 recipient households compared to non-recipient households. The findings indicate that
 336 microcredit has a significantly positively effect on FCS for all matching algorithms. The FCS
 337 score is higher for recipient households (45.82-46.23) than non-recipient households (35.17-
 338 36.56). This means microcredit has increased the FCS score by 25.9-31.4% for recipient
 339 households compared to non-recipient households. These results are consistent with the
 340 literature (Hamad and Fernald, 2012; Islam et al., 2016; Devereux, 2016; Bocher et al., 2017;
 341 Kianersi et al., 2021; Haque, 2021; Berhanu et al., 2021; Bahiru et al., 2023; Woleba et al.,
 342 2023; Kolog et al., 2023; Wongnaa et al., 2023; Boltana et al., 2023), revealing that microcredit
 343 through investing in income-generating activities, creating diverse income streams and safe
 344 networks, reducing vulnerability to health shocks, and improving the flow of information on
 345 household health and nutrition programs help to enhance of food security of households.
 346 However, some studies showed that microcredit has no significant effect on food security
 347 (Banerjee et al., 2015; Seng, 2018; Mahmud et al., 2022; Salima et al., 2023). In addition, other
 348 studies have shown that microcredit may push households into food insecurity situations by

349 creating excessive debt and loan repayment pressure (Develtere and Huybrechts, 2005;
350 Aromolaran, 2010; Ganle et al., 2015; Namayengo et al., 2018; Ahmed et al., 2021).

351

352 **Table 5.** Impact of microcredit accessed on HFIAS and FCS indices.

Outcome	Matching	Controls	Treated	ATT	Bootstrap S.E.	T-stat	Matched observations		
							All sample	Credit accessed	No Credit
HFIAS	Neighbor	13.538	9.848	-3.690	0.649	-5.686***	369	171	198
	Kernel	12.954	9.797	-3.157	0.460	-6.864***	376	177	199
	Radius	13.834	9.986	-3.847	0.580	-6.635***	376	177	199
FCS	Neighbor	35.871	45.819	9.947	2.733	3.640***	369	171	198
	Kernel	36.564	46.023	9.458	2.530	3.738***	376	177	199
	Radius	35.168	46.229	11.061	1.587	6.970***	376	177	199

Note: Bootstrap S.E: Bootstrap standard error with 1000 times simulations. *** Significant at $P < 0.01$.

353

354 **3.4. Sensitivity analysis for hidden bias**

355 Table 6 shows the results of checking hidden bias by sensitivity analysis. Our findings reveal
356 that the effect of microcredit interventions on HFIAS and FCS indices does not change, and
357 the households are allowed to differ in their odds of treatment by 200% $((3-1)*100)=200$ at
358 $\Gamma = 3$ in terms of unobserved covariates in both groups. Therefore, it can be concluded that the
359 results of ATT for all output variables are not sensitive to unobserved hidden bias, and the
360 estimated effect is a pure effect of using microcredit. This finding is consistent with the results
361 of Berhanu et al. (2021) and Boltana et al. (2023).

362

363 **Table 6.** Sensitivity analysis of Outcome variables.

Gamma (Γ)	HFIAS		FCS	
	Significant-	Significant+	Significant-	Significant+
1	0.00	0.00	0.00	0.00
1.2	0.00	0.00	0.00	0.00
1.4	0.00	0.00	0.00	0.00
1.6	0.00	0.00	0.00	0.00
1.8	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00
2.2	0.00	0.00	0.00	0.00
2.4	0.00	0.00	0.00	0.00
2.6	0.00	0.00	0.00	0.00
2.8	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00

Note: Γ : Log odds of unobserved differential assignment. Significant-: lower bound significance level.
Significant+: upper bound significance level.

364

365 **4. Conclusions**

366 This study seeks to answer how microcredit plans lead to enhance the households' food security by
367 developing the PSM method through the bootstrap algorithm. The findings emphasize the positive role
368 of microcredit in reducing the HFIAS and increasing the FCS. However, a large number of target
369 households are food insecure and do not have a good condition in terms of food consumption; because
370 a significant number of them did not have access to or did not receive microcredit for various reasons.

371 The results showed that the access of households to microcredit was positively influenced by high
372 awareness of adaptation strategies, access to climate change information, the household head's
373 education, the number of helpers, the number of household contacts with agricultural extension
374 institutions, household size, agricultural land size, the value of crop losses and the number of lost
375 livestock. However, the household head's age, households' savings, and dependence ratio have a
376 negative effect on the access of households to microcredit.

377 Based on these findings, this study proposes the following policy implications. **First, non-governmental**
378 **organizations and local social associations should be further promoted and strengthened to increase**
379 **households' access to rural microcredit. In addition, they should be flexible in accepting natural**
380 **guarantees such as agricultural land and household livestock and social guarantees such as membership**
381 **in social groups to increase the level of households' access to microcredit.** Second, non-governmental
382 and governmental organizations providing microcredit should emphasize the organizing effective
383 training programs to increase households' knowledge and skills. This leads to improved households'
384 food security through individual development and collective participation. These organizations should
385 target educated rural youth with suitable incentive programs. Educated youths have high capacities for
386 correctly using microcredit in income-generating activities, which can provide a basis for improving
387 food security in rural communities.

388 Although this study has provided several new insights about the effect of microcredit on food security,
389 some limitations need to be considered in future research. First, future studies can expand the subject
390 of this study using other food security indices such as the Household Dietary Diversity Score (HDDS)
391 (Wongnaa et al., 2023; Borku et al., 2024), and other methods like the Endogenous Switching Model
392 (Salima et al., 2023). Second, considering the limited data availability, this study uses a cross-section
393 sample. Future research can achieve more comprehensive findings using panel data (Islam et al., 2016).

394

395 REFERENCES

- 396 1. Ahmed, F., Islam, A., Pakrashi, D., Rahman, T., & Siddique, A. 2021. Determinants and dynamics
397 of food insecurity during COVID-19 in rural Bangladesh. *Food Policy*, **101**: 102066.
- 398 2. Akbari and Danaie (2018). Microfinance Program with Linked Banking Approach in Iran
399 (Frameworks, Performance and Challenges). *Deputy for Entrepreneurship and Employment*
400 *Development, Ministry of Cooperatives Labor and Social Welfare (Office of Policy Making and*
401 *Employment Development)*, 35-1.
- 402 3. Akotey, J. O., & Adjasi, C. K. 2016. Does microcredit increase household welfare in the absence of
403 microinsurance? *World Development*, **77**: 380-394.
- 404 4. Aromolaran, A. B. 2010. Does increase in women's income relative to men's income increase food
405 calorie intake in poor households? Evidence from Nigeria. *Agricultural Economics*, **41**: 239-249.

- 406 5. Austin, P. C., & Small, D. S. 2014. The use of bootstrapping when using propensity-score matching
407 without replacement: a simulation study. *Statistics in medicine*, **33(24)**: 4306-4319.
- 408 6. Bahiru, A., Senapathy, M., & Bojago, E. 2023. Status of household food security, its determinants,
409 and coping strategies in the Humbo district, Southern Ethiopia. *Journal of Agriculture and Food*
410 *Research*, **11**: 100461.
- 411 7. Bakare, A. Y., Ogunleye, A. S., & Kehinde, A. D. 2023. Impacts of microcredit access on climate
412 change adaptation strategies adoption and rice yield in Kwara State, Nigeria. *World Development*
413 *Sustainability*, **2**: 100047.
- 414 8. Banerjee, A., Duflo, E., Glennerster, R., & Kinnan, C. 2015. The miracle of microfinance? Evidence
415 from a randomized evaluation. *American economic journal: Applied economics*, **7(1)**: 22-53.
- 416 9. Baumann, S. M., Webb, P., & Zeller, M. 2013. Validity of food consumption indicators in the Lao
417 context: Moving toward cross-cultural standardization. *Food and nutrition bulletin*, **34(1)**: 105-119.
- 418 10. Becker, S. O., & Ichino, A. (2002). Estimation of average treatment effects based on propensity
419 scores. *The stata journal*, **2(4)**: 358-377.
- 420 11. Berhanu, A., Amare, A., Gurmessa, B., Bekele, Y., & Chalchisa, T. 2021. Does microcredit use
421 help farmers win battle against food insecurity: evidence from Jimma zone of Southwest
422 Ethiopia. *Agriculture & Food Security*, **10(1)**: 1-17.
- 423 12. Bocher, T. F., Alemu, B. A., & Kelbore, Z. G. 2017. Does access to credit improve household
424 welfare? Evidence from Ethiopia using endogenous regime switching regression. *African Journal of*
425 *Economic and Management Studies*, **8(1)**: 51-65.
- 426 13. Boltana, A., Tafesse, A., Belay, A., Recha, J. W., & Osano, P. M. 2023. Impact of credit on
427 household food security: The case of Omo microfinance institution in southern Ethiopia. *Journal of*
428 *Agriculture and Food Research*, **14**: 100903.
- 429 14. Borku, A. W., Utallo, A. U., & Tora, T. T. 2024. The level of food insecurity among urban
430 households in southern Ethiopia: A multi-index-based assessment. *Journal of Agriculture and Food*
431 *Research*, 101019.
- 432 15. Chowdhury, R. B., Moore, G. A., Weatherley, A. J., & Arora, M. 2017. Key sustainability
433 challenges for the global phosphorus resource, their implications for global food security, and options
434 for mitigation. *Journal of Cleaner Production*, **140**: 945-963.
- 435 16. Coates, J., Swindale, A., & Bilinsky, P. 2007. Household Food Insecurity Access Scale (HFIAS)
436 for measurement of food access: indicator guide: version 3.
- 437 17. Dehbidi, N. K., Zibaei, M., & Tarazkar, M. H. 2022. The effect of climate change and energy
438 shocks on food security in Iran's provinces. *Regional Science Policy & Practice*, **14(2)**: 417-438.
- 439 18. Develtere, P., & Huybrechts, A. 2005. The impact of microcredit on the poor in
440 Bangladesh. *Alternatives*, **30(2)**, 165-189.

- 441 19. Devereux, S. 2016. Social protection for enhanced food security in sub-Saharan Africa. *Food*
442 *policy*, **60**: 52-62.
- 443 20. Ebrahimzadeh, E., & Paidar, A. (2019). Planning of rural economic development and employment
444 based on the propulsion and the chain of the past Case study; Abolfazl Mosque Village in
445 Iranshahr. *Geography and Development*, **17(57)**: 1-30.
- 446 21. Ehtesham Majd, S., Omidi Najafabadi, M., Lashgarara, F., & Mirdamadi, S. M. 2019. Gender
447 Disparity in Food Security Status of Rural Households Based on Sustainable Livelihoods in
448 Kermanshah County. *Journal of Agricultural Science and Technology*, **21(7)**: 1691-1704.
- 449 22. FAO, IFAD, UNICEF, WFP and WHO. 2022. The State of Food Security and Nutrition in the
450 World 2022. Repurposing food and agricultural policies to make healthy diets more affordable. Rome,
451 FAO.
- 452 23. Ganle, J. K., Afriyie, K., & Segbefia, A. Y. 2015. Microcredit: Empowerment and
453 disempowerment of rural women in Ghana. *World development*, **66**: 335-345.
- 454 24. Ghalibaf, M. B., Gholami, M., & Ahmadi, S. A. 2023. Climate Change, Food System, and Food
455 Security in Iran. *Journal of Agricultural Science and Technology*, **25(1)**: 1-17.
- 456 25. Greene, W. H. (2012). *Econometric analysis*. 71e. *Stern School of Business, New York University*,
457 **721-723**.
- 458 26. Guo, S., & Fraser, M. W. (2014). *Propensity score analysis: Statistical methods and*
459 *applications* (Vol. 11). SAGE publications.
- 460 27. Hamad, R., & Fernald, L. C. 2012. Microcredit participation and nutrition outcomes among women
461 in Peru. *J Epidemiol Community Health*, **66(6)**: 1-7.
- 462 28. Haque, S. 2021. Role of Microcredit in Improving the Food Security Status of the Rural Poor
463 Women: Evidence from Bangladesh. *Journal of Business*, **6(2)**: 01-14.
- 464 29. Islam, A., Maitra, C., Pakrashi, D., & Smyth, R. 2016. Microcredit Programme participation and
465 household food security in rural Bangladesh. *Journal of Agricultural Economics*, **67(2)**: 448-470.
- 466 30. Jones, A. D., Ngunjiri, F. M., Pelto, G., & Young, S. L. 2013. What are we assessing when we
467 measure food security? A compendium and review of current metrics. *Advances in nutrition*, **4(5)**: 481-
468 505.
- 469 31. Kandel, G. P., Bavorova, M., Ullah, A., & Pradhan, P. 2024. Food security and sustainability
470 through adaptation to climate change: Lessons learned from Nepal. *International Journal of Disaster*
471 *Risk Reduction*, **101**: 104279.
- 472 32. Kianersi, S., Jules, R., Zhang, Y., Luetke, M., & Rosenberg, M. 2021. Associations between
473 hurricane exposure, food insecurity, and microfinance; a cross-sectional study in Haiti. *World*
474 *development*, **145**: 105530.

- 475 33. Kolog, J. D., Asem, F. E., & Mensah-Bonsu, A. 2023. The state of food security and its
476 determinants in Ghana: an ordered probit analysis of the household hunger scale and household food
477 insecurity access scale. *Scientific African*, **19**: e01579.
- 478 34. Li, X., Gan, C., & Hu, B. 2011. Accessibility to microcredit by Chinese rural households. *Journal*
479 *of Asian Economics*, **22(3)**: 235-246.
- 480 35. Liu, X., Shi, L.J., Engel, B.A., Sun, S.K., Zhao, X.N., Wu, P.T., Wang, Y.B., 2020. New challenges
481 of food security in Northwest China: water footprint and virtual water perspective. *Journal of Cleaner*
482 *Production*, **245**.
- 483 36. Luan, D. X., & Bauer, S. 2016. Does credit access affect household income homogeneously across
484 different groups of credit recipients? Evidence from rural Vietnam. *Journal of rural studies*, **47**: 186-
485 203.
- 486 37. Mahmud, K. T., Parvez, A., Ahmed, S. S., & Rafiq, F. 2022. Microcredit and the household food
487 security of the fish farmers: evidence from rural Bangladesh. *Development in Practice*, **32(8)**: 1091-
488 1100.
- 489 38. Marincioni, F., Appiotti, F., Pusceddu, A., & Byrne, K. 2013. Enhancing resistance and resilience
490 to disasters with microfinance: Parallels with ecological trophic systems. *International Journal of*
491 *Disaster Risk Reduction*, **4**: 52-62.
- 492 39. Namayengo, F. M., Antonides, G., & Cecchi, F. 2018. Microcredit and food security: Evidence
493 from rural households in Uganda. *Journal of African Economies*, **27(4)**: 457-482.
- 494 40. Ojo, T. O., Baiyegunhi, L. J. S., & Salami, A. O. 2019. Impact of credit demand on the productivity
495 of rice farmers in South West Nigeria. *Journal of Economics and Behavioral Studies*, **11(1)**, 166-180.
- 496 41. Okati, M., ahmadpour borazjani, M., & Sarani, V. (2020). Recognizing the factors affecting on
497 food security in rural areas (Case study of villages in Zehak region in Sistan and Baluchestan
498 province). *Rural Development Strategies*, **7(2)**: 199-209.
- 499 42. Rosenbaum, P. R. (2002). *Overt bias in observational studies* (pp. 71-104). Springer New York.
- 500 43. Salima, W., Manja, L. P., Chiwaula, L. S., & Chirwa, G. C. 2023. The impact of credit access on
501 household food security in Malawi. *Journal of Agriculture and Food Research*, **11**: 100490.
- 502 44. Salman, M., Haque, S., Hossain, M. E., Zaman, N., & Hira, F. T. Z. 2023. Pathways toward the
503 sustainable improvement of food security: Adopting the household food insecurity access scale in rural
504 farming households in Bangladesh. *Research in Globalization*, **7**: 100172.
- 505 45. Sani Heidary, A., Daneshvar Kakhki, M., Shanoushi, N., & Sabouhi Sabouni, M. 2020. Analysis
506 of the Effect of Microcredit on Rural Sustainable Development Components: Application of Propensity
507 Score Regression Approach and Bootstrap Algorithm. *Agricultural Economics*, **14(1)**: 47-87.
- 508 46. Schillerberg, T., & Tian, D. 2023. Changes in crop failures and their predictions with agroclimatic
509 conditions: Analysis based on earth observations and machine learning over global
510 croplands. *Agricultural and Forest Meteorology*, **340**: 109620.

- 511 47. Seng, K. 2018. Revisiting Microcredit's Poverty-Reducing Promise: Evidence from
512 Cambodia. *Journal of International Development*, **30(4)**, 615-642.
- 513 48. Thanh, P. T., Saito, K., & Duong, P. B. 2019. Impact of microcredit on rural household welfare
514 and economic growth in Vietnam. *Journal of Policy Modeling*, **41(1)**: 120-139.
- 515 49. Woleba, G., Tadiwos, T., Bojago, E., & Senapathy, M. 2023. Household food security,
516 determinants and coping strategies among small-scale farmers in Kedida Gamela district, Southern
517 Ethiopia. *Journal of Agriculture and Food Research*, **12**: 100597.
- 518 50. Wongnaa, C. A., Abudu, A., Abdul-Rahaman, A., Akey, E. A., & Prah, S. 2023. Input credit
519 scheme, farm productivity and food security nexus among smallholder rice farmers: evidence from
520 North East Ghana. *Agricultural Finance Review*, **83(4/5)**: 691-719.
- 521 51. World Bank. 2008. *World development report 2008: Agriculture for development*. World Bank.

522

523

524

525

526

527

528

529

530

531

532

533

534

535

536

537

538

539

540

541

Appendix

542 **Table A1. Measurement of HFIAD and HFIAP.**

Index	Category	Calculation
HFIAD	Insufficient food intake and physical consequences	Number of respondents to Q5 to Q9=1
	Anxiety and uncertainty	Number of respondents to Q2 to Q4=1
	Insufficient Quality	Number of respondents to Q1=1
HFIAP	Severely food insecure	Number of respondents to Q5a=3 or Q6a=3 or Q7a=1 or 2 or 3; or Q8a=1 or 2 or 3; or Q9a= 1 or 2 or 3.
	Moderately food insecure	Number of respondents to Q3a=2 or 3; or Q4a=2 or 3; or Q5a=1 or 2; or Q6a=1 or 2.
	Mildly food insecure	Number of respondents to Q1a=2 or 3; or Q2a=1 or 2 or 3; or Q3a=1 or Q4a=1.
	Food secure	Number of respondents to Q1a=0 or 1.

Note: Q1 to Q9 denotes occurrence questions, while Q1a to Q9a represents their frequency.

Source: Coates et al. 2007.

543 **Table A2. Demographic background of the sampled households.**

Variables	Group	Frequency	Percentage	
Age of the household head	35-45	70	19	
	46-55	100	27	
	56-65	118	31	
	65>	88	23	
Education level of household heads	Not able to read and write	133	35	
	primary education	84	22	
	secondary education	102	27	
	higher education	57	15	
Sex of household head	Female	74	20	
	Male	302	80	
Economic activities of households	Farming	144	38	
	Livestock farming	148	39	
	shopkeeper	24	6	
	Handicrafts	47	13	
	Employee	13	3	
Fields of Microcredit Receipts of Households	Consumption	38	10	
	Working capital	56	15	
	Agriculture	113	30	
Loan size of households (Million Rials (IRR))	Livestock	169	45	
	Consumption	150-300	38	10
	Working capital	350-500	56	15
	Agriculture	450-700	113	30
Livestock	700-1000	169	45	

544

545

546

547

548

549

550

551

552 ارزیابی اثرات اعتبارات خرد بر وضعیت امنیت غذایی خانوارهای روستایی تحت تاثیر خشکسالی:
553 مطالعه تجربی از روستاهای شهرستان زهک، ایران

554

555 علیرضا ثانی حیدری، محمود دانشور کاخکی، محمود صبوحی صابونی، و حسین محمدی

556

چکیده

557 اعتبارات خرد نقش حیاتی در امنیت غذایی خانوارهای روستایی دارد. با این حال، اثرات اعتبارات خرد بر بهبود امنیت
558 غذایی خانوارها هنوز در ایران به خوبی مورد مطالعه و درک قرار نگرفته است. لذا این پژوهش با هدف بررسی موفقیت
559 برنامه‌های اعتبارات خرد در ارتقای امنیت غذایی خانوارهای روستایی شهرستان زهک با استفاده از روش تطبیق امتیاز
560 گرایش و الگوریتم بوت استرپ انجام شده است. برای این منظور از دو شاخص امنیت غذایی شامل مقیاس دسترسی به
561 ناامنی غذایی خانوار (HFIAS) و امتیاز مصرف غذا (FCS) استفاده می‌شود. نتایج نشان داد که 100 درصد خانوارها
562 با ناامنی غذایی مواجه هستند. شیوع ناامنی غذایی برای ناامنی غذایی خفیف، متوسط و شدید به ترتیب 20، 42/5 و 37/5
563 درصد بود. علاوه بر این، 30 درصد خانوارها در وضعیت نامناسب مصرف مواد غذایی قرار دارند. یافته‌های ما بر
564 نقش مثبت و قابل توجه اعتبار خرد در بهبود امنیت غذایی تاکید می‌کند. نتایج نشان داد اعتبار خرد امتیاز شاخص
565 HFIAS خانوارهای دریافت‌کننده را بین 24/31-27/81 درصد کاهش و امتیاز شاخص FCS را بین 25/78-31/45
566 درصد افزایش داده است. بنابراین، سیاست‌گذاران و تصمیم‌گیران باید سازمان‌های دولتی و غیردولتی ارائه دهنده
567 اعتبارات خرد را ترویج و تقویت کنند. همچنین ارائه اطلاعات و کاهش محدودیت‌های وثیقه برای افزایش دسترسی
568 خانوارها به اعتبارات خرد توصیه می‌شود.