



RESEARCH ARTICLE

Impact of millets FPOs on the socio-economic and livelihood of millet growers

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Abstract

Majority of the farmers in India depend on agriculture, which is one of the major sources of the country's economy. Global population raise and their feeding has become one of the major concerns. Millets (Shree Anna) are nutritionally rich and can address the Sustainable Development Goals (SDGs). Cultivating millets holds economic importance since they are frequently raised by smallholder farmers in developing nations, offering them a means of livelihood and food stability. Farmer collectives such as Millet FPOs, engaged in millet cultivation and promotion. Millet FPOs have the potential to overcome the challenges faced by millet growers through collective interventions. The present study was conducted to assess the impact of millet FPOs on the socio-economic and livelihood status of millet growers. A total of 360 farmers were randomly selected from 8 millet FPOs promoted by ICAR-IIMR, Hyderabad. Data on occupational days, annual income, monthly expenditure, savings, access to credit, debt status, employment patterns and credit repayment were collected during 2025. Both parametric and non-parametric statistical tools were employed for analysis. Results indicated a significant improvement in the socio-economic status of farmers after joining millet FPOs, with notable gains in annual income, occupational days, monthly savings, expenditure, credit access, debt management, economic activities and repayment discipline. Hypothesis testing showed that the 't'-values for annual income (24.583), occupational days (62.274), savings (44.845), expenditure (38.535) and credit availability (14.083) were significant at the 1 % level.

Keywords: economic wellbeing; farmer collectives; living standards; millet-FPOs; nutrition; shree anna

Introduction

Agriculture has been the foundation of human civilization and it continued to play a central role in global development (1). Agriculture and its allied activities contribute to the primary sector in India and serves as base for the country's economy (2). It ensures food security, provides raw materials to various industries, creates employment to global population and sustains rural economies at grass root levels (3). Indian agriculture landscape is not just an economic activity (4) and is deeply intertwined with social, cultural, economic and traditional parameters (5). Agriculture has long remained the backbone of the Indian economy, employing nearly 43.51 % of the country's workforce and about 46.1 % of the Indian population dependent on agriculture and allied activities (5,6). Majority (89.4 %) of the farmers in India are marginal and small with cultivating land of less than 2 hectares (7,8). However, the agricultural sector faces numerous challenges like fragmented landholdings (9), declining soil fertility, erratic weather patterns due to climate change (10), inadequate access to irrigation and lack of modern technology adoption (11). These challenges directly reduce

productivity as fragmented landholdings limit mechanization, declining soil fertility lowers yields, erratic weather increases risks, inadequate irrigation restricts cropping and poor technology adoption hampers efficiency. Together, they trap small and marginal farmers in low yields and incomes. Farmers also face difficulties in accessing quality seeds, fertilizers and credit, while postharvest losses and poor market infrastructure reduce their earnings (12). The sector's vulnerability is further exposed by fluctuating prices, limited value addition and weak supply chain linkages (13).

India is a global agricultural leader, ranking first in rice, pulses, spices and millets (contributing nearly 40 % of global millet output), second in wheat, fruits and vegetables after China (14). However, despite this strong production base, Indian agriculture continues to face structural and operational challenges that affect its overall efficiency and profitability (15,16). Global population growth and feeding them has become a major concern (17). With the rising global population and increasing demand for food, agriculture holds the key in addressing issues like hunger, poverty and malnutrition (18).

In the context of addressing SDGs such as zero hunger, climate action, no poverty and malnutrition, currently millets (Shree Anna) are gaining renewed global attention due to their high nutritional profile (19-21). Millets are highly nutritious, providing per 100g: protein 7.3-13g (highest in teff 13 g, proso millet 12.5 g), fibre 1.3-12.5 g (highest in brown top millet 12.5 g, fonio 11.3 g), minerals 0.85-5.31g (highest in fonio 5.31g, barnyard millet 4.4g), calcium 0.01-344mg (highest in finger millet 344mg, teff 180mg) and iron 0.5-84.8mg (highest in fonio 84.8mg, pearl millet 16.9mg), making them highly beneficial for combating malnutrition. Millets are consumed by more than one-third of the world's population (22). Sorghum, pearl millet and finger millet are major millets while foxtail, kodo, proso, little, browntop and barnyard millet are minor millets (23). All these millets were in cultivation in India for centuries (24). Millets are rich in nutrition and were called climate smart crops due to their climate resilient nature. Millet cultivation is the livelihood crop for tribals, *adivasi* and hilly area farmers (25). Cultivating millets holds economic importance since they are frequently raised by smallholder farmers in developing nations, offering them a means of livelihood and food stability (26,27).

Promotion of Farmer Producer Organisations (FPOs) and farmer collectives has become a national priority (through Central Sector Scheme for the formation of 10000 FPO scheme during 2020) to overcome these hurdles and strengthen the unified advocacy of small and marginal farmers (28). FPOs are small groups of farmers who work together for increasing their bargaining power through collective procurement, processing and marketing activities (29). The shareholders of the FPOs are marginal, small farmers, landless and tenant farmers (30). As a social network, FPOs also play an important role in information dissemination (31). Farmers' collectives minimize costs by spreading fixed costs associated with production, storage, transportation and marketing (32,33). Millet FPOs are farmer collectives that are involved in millet farming and millet promotion (34). They are involved in millet aggregation, establishing millet primary processing units, millet aggregation, value addition, marketing, branding and millet entrepreneurship (35). Millet FPOs are bridging agents in empowering millet grower's livelihoods and are responsible for sustainable agriculture promotion (36). Millet FPOs help small, marginal and landless farmers to improve their economic situation and health by giving them a place to pool their resources (37), share information, have access to technology (38,39) and work together to get better pricing for their crops (40).

To strengthen the FPO system from the base of pyramid, Government of India has taken an initiative to support small, marginal and tenant farmers with the support of knowledge partners named as cluster-based business organizations (41). Taking the expertise of ICAR-IIMR, Hyderabad in millet arena, the institute

was sanctioned with 40 millet FPOs by various implementing agencies with an objective to promote millets across India. Despite having multiple advantages, millet farming has decreased over time due to low market demand, inadequate processing facilities, lack of remunerative prices, postharvest technology handling and lack of awareness among both consumers and farmers (42). Millet FPOs has the potential to overcome these challenges through collective interventions. To understand the impact of millets FPOs on socio-economic and livelihood of millet growers the present was conducted.

Materials and Methods

Research methods

The present quantitative research investigation was conducted with 360 millet growers during 2024-25. The millet growers cultivating both major and minor millets were members of FPOs promoted by ICAR-IIMR, Hyderabad. Millet FPOs promoted by IIMR was selected purposively as the major operational crop for FPOs was millet in both the seasons. Millet FPOs selected for the study were from Andhra Pradesh and Karnataka states of India. Four FPOs were selected from each state, resulting in a total of 8 FPOs. From each millet FPO 45 millet growers were taken and from each state 180 millet growers were included. Thus, a total of 360 millet growers from 8 FPOs were selected randomly and included for the study as shown in Table 1. The present study was designed to assess the socio-economic aspects of millet growers who were part of millet FPOs promoted by ICAR-IIMR, Hyderabad under the 10K Central Sector Scheme (CSS) FPO scheme of India. The criteria employed for the inclusion of ICAR-IIMR promoting FPOs were that it focuses solely on millets and possesses expertise in the entire subject domain, ranging from fundamental research to advanced investigations in millet production, processing, value addition and market connections (43). ICAR-IIMR, Hyderabad acts as Cluster Based Business Organization (CBBO) and is involved in promotion of 40 millet based FPOs in Andhra Pradesh, Karnataka, Madhya Pradesh and Telangana. Millet FPOs based on the existence of 3 years annual audit report, FPO with minimum of 500 member farmers, millet crop cultivation in both cropping seasons, output marketing of millets and millet value addition adoption were selected for the present study.

Data collection

A well-framed interview schedule was designed with the help of agriculture domain experts, scientists, project managers and extension experts of ICAR-IIMR, Hyderabad and agriculture department officials. The interview schedule collected information on socio-economic aspects like occupational days (employment levels), annual income and monthly expenses, savings behaviour

Table 1. List of selected FPOs

S. No	State	Name of the FPO	Block	Number of farmers	Millet crops
1	Karnataka	Hulsoor Mahila Kisan Millets Producer Company Limited	Hulsoor	45	Ragi, Foxtail, Little, Sorghum
2		Shorapur Taluka Millets Farmers Producer Company Limited	Shorapur	45	Bajra, Sorghum, Foxtail
3		Bettada Basaveshwara FPCL	Sirwar	45	Barnyard, Foxtail, Proso, Bajra
4		Jewargi Taluka FPCL	Jewargi	45	Foxtail, Sorghum, Bajra
5	Andhra Pradesh	Lambasingi Tribal FPCL	Chintapalli	45	Ragi, Foxtail, Little, Sorghum
6		Giri Siri Tribal FPCL	Paderu	45	Ragi, Foxtail, Little, Sorghum
7		Sri Alluri FPCL	Hukumpeta	45	Ragi, Foxtail, Little, Sorghum
8		Sri Matsadevatha FPCL	G. Madugula	45	Ragi, Foxtail, Little, Sorghum, Barnyard
		Total		360	

and flow, ownership of domestic assets, access to credit and debt status, economic activity and patterns of employment, discipline in credit repayment (44). The data was collected during the last quarter of FY 2024 and was analyzed during March 2025. The collected raw data was entered and coded in SPSS-26 software and Excel-2019. Analysis was aimed to assess the socio-economic indicators of millet growers before and after joining the millet FPOs (45). Employing a retrospective panel method, data concerning the period before engaging with the FPOs was gathered and contrasted with the current circumstances following participation in the FPOs (46). Since, the typical membership length of member farmers was 3.2 years, there was sufficient time to assess the impact. To arrive at substantial conclusions, statistical and analytical techniques such as percentage analysis, both parametric and non-parametric methods were employed to verify the reliability of data and to extract significant conclusions.

Hypothesis

Null hypothesis

No significant difference exists between the selected components of the beneficiaries before and after joining FPOs.

Alternate hypothesis

A significant difference exists between the selected components of the beneficiaries before and after joining FPOs.

Analytical tools

Analytical tools were used to assess the statistical relevancy of collected data and to analyse the socio-economic impact of the selected variables with the following tools.

Percentage analysis

Percentage analysis was utilized to examine the distribution of respondents relative to the selected variables in the study region. To obtain a legitimate result, the percentage of these attributes was calculated using the equation below:

Percentage analysis =

$$\frac{\text{Number of respondents}}{\text{Total sample size}} \times 100 \quad (\text{Eqn. 1})$$

't' test

A paired t-test was utilized to evaluate two population means where observations from one sample could be matched with those from another sample. It was also used for testing the significance of difference in the group of observations and socio-economic impact of respondents in FPOs. The t-statistic was computed using the equation below:

$$t = \frac{D}{Sd/\sqrt{n}} \quad (\text{Eqn. 2})$$

Where,

D = Mean difference

Sd = Standard error of the mean difference

n = Size of the sample

Chi-square test

Chi-square test was conducted to determine the distributions of variables which are distinct from each other. In the current research, this test was employed to examine the interrelation among the categorical variables utilizing the equation mentioned below:

$$X^2 = \sum (O_i - E_i)^2 / E_i \quad (\text{Eqn. 3})$$

Where,

X² = Chi-square value

O = Observed value of the two variables

E = Expected value of the two variables

"i" = "ith" position in the contingency table

Wilcoxon signed rank test

It is a non-parametric test that was used for testing the socio-economic impact of FPOs. It was used to compare matched pairs and evaluate differences against the median with the equation mentioned below:

$$z = \frac{w_s - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}} \quad (\text{Eqn. 4})$$

Where,

n = number of pairs where difference was not 0

w_s = Smallest of absolute values of the sums

Results and Discussion

The transformations in the socio-economic characteristics of beneficiary millet growers involved in millet FPOs under the 10K CSS FPO scheme were analysed to assess the influence of FPOs. The effect on members was evaluated by comparing the variations of chosen socio-economic factors from the time of joining FPOs to their current position. Profile traits that were used to evaluate the impact were occupational days, annual income, expenditure, credit availability, debt status, flow of savings, economic activity chosen, occupational pattern, domestic assets, diet composition and credit repayment. Trait scores for each component of the respondents prior to joining FPOs and their present status were gathered, statistically analysed and represented below.

The changes in socio-economic status of millets growers like occupational days, annual income, monthly expenditure, credit availability and debt status status was tabulated in Table 2 (47). The average number of occupational days of millet growers before joining FPOs was 154.62 days, while their present status of occupational days was 234.32 days. The 't'-value for occupational days was 62.274, which was significant at the 1 % level of significance (p < 0.01) with 359 degrees of freedom. This was accompanied by a very large effect size (Cohen's d ≈ 3.74), indicating a substantial improvement in farmers' engagement in agricultural activities. There was a significant increase in number of occupational days of millet grower after becoming member of millet FPOs and hence null hypothesis was rejected. This suggests that FPO membership has improved and stabilized employment opportunities for farmers as shown in Fig. 1.

According to Table 2, the annual income showed a significant rise from ₹51885 to ₹115781 with a large effect size (d ≈ 1.40), reflecting the economic benefits associated with FPO participation. Fig. 2 also indicated the significant improvement in the income levels of millet growers after joining millet FPOs and thus leading to the rejection of null hypothesis. The statistical 't'-value for annual income was 24.583, which was significant at 1 % LOS with 'p'-value < 0.01, at 359 degrees of freedom. Monthly savings of millet growers also showed a noteworthy increase after becoming the part of millet FPOs. Before joining the FPO, the average amount saved by

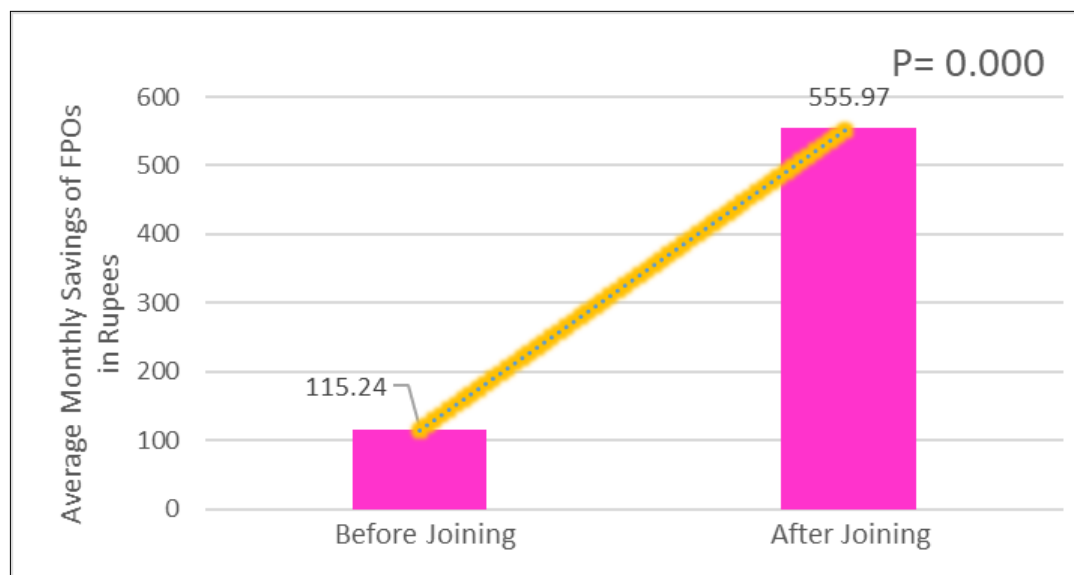


Fig. 1. Change in the monthly savings of the FPO beneficiaries.

Table 2. Change in the socio-economic status of millet growers through millet FPOs

Feature	Stage	Mean	N	Standard deviation	‘t’-value	Df	‘p’-value	Effect size (Cohens d)
Occupational days	Before joining FPO	154.62	360	15.22	62.274**	359	0.000	3.74
	Present status	234.32	360	26.027				
Annual income	Before joining FPO	51,885	360	13567.31	24.583**	359	0.000	1.40
	Present status	1,15,781	360	50534.32				
Monthly savings	Before joining FPO	115.24	360	21.20	44.845**	359	0.000	2.53
	Present status	555.97	360	183.72				
Monthly expenditure	Before joining FPO	3597.23	360	783.25	38.535**	359	0.000	2.06
	Present status	5519.69	360	978.49				
Credit availability	Before joining FPO	57,141.13	360	12025.79	14.083**	359	0.000	0.82
	Present status	1,68,122.78	360	145979.84				
Debt status	Before joining FPO	140925.37	360	34249.27	11.971**	359	0.000	1.18
	Present status	100503.85	360	62925.19				

**Statistically significant at 1 % level of probability

millet growers was ₹115.24 and after joining it increased to ₹555.97. The significant ‘t’-value for monthly saving income was 24.583, which was significant at 1 % LOS with ‘p’-value < 0.01, at 359 degrees of freedom. This result was associated with a very large effect size (Cohen’s $d \approx 2.53$), suggesting enhanced financial stability among the members. This implies that millet growers had better financial capacity and planning skills after becoming the members of millet FPOs as shown in Table 2.

The amount spent each month by the millet grower has also changed, rising from ₹3597.23 to ₹5519.69 with a large effect size ($d \approx 2.06$), indicating improved purchasing power as shown in Table 2 and Fig. 3. Better purchasing power and more disposable income of millet growers after joining FPOs were the probable reasons for the increased living standards and for the rejection of null hypothesis. Changes in credit availability of millet growers was shown in Table 2 and Fig. 4. Millet growers have much greater access to credit after becoming the members of millet FPOs. This notable shift highlights the crucial role of FPOs in advancing financial inclusion and improving farmers’ access to institutional credit sources, with a moderate to large effect size (Cohen’s $d \approx 0.82$), demonstrating significantly greater access to formal financial resources (48).

Results from Table 2, showed that average debt amount of millet growers dropped from ₹140925.37 to ₹100503.85. The ‘t’-value

for debt status was 11.971, which was significant at 1 % LOS with ‘p’-value < 0.01, at 359 degrees of freedom. Cohen’s $d \approx 1.18$ indicated a large effect size, showing a substantial reduction in debt after joining the FPO. As there was a significant reduction in debt status of millet growers after becoming the member of millet FPOs the null hypothesis was rejected. Due to increase in occupational days, annual income and credit availability of millet growers the loan repayment by the farmers was timely and because of this burden of debts was reduced after joining FPOs (48) (Fig. 5).

Savings pattern of millet growers before and after joining FPOs was drafted in Table 3. FPO participation by millet growers had significantly influenced the regularity of savings among farmers enhancing financial discipline. Prior to becoming members of the millet FPO, only 21.90 % of the millet growers reported to regular savings, while 78.10 % millet growers had irregular saving habits (49). However, following their involvement with the FPO, a remarkable shift of 80.6 % occurred with regular savings and only 19.40 % continued with irregular savings. This transformation was statistically validated by Wilcoxon signed-rank test with z-value of 13.648 and p-value of 0.01, at 1 % level of probability. As per the results, millet grower regular saving practices had been greatly aided by FPO membership. Access to financial services through FPO framework had increased financial literacy and through increased

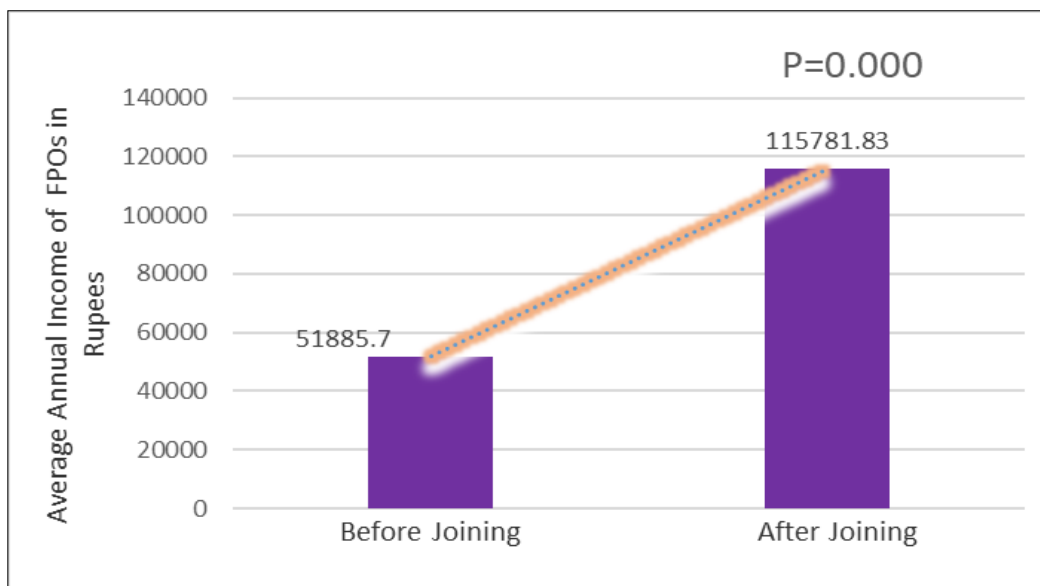


Fig. 2. Change in the annual income of the FPO beneficiaries.

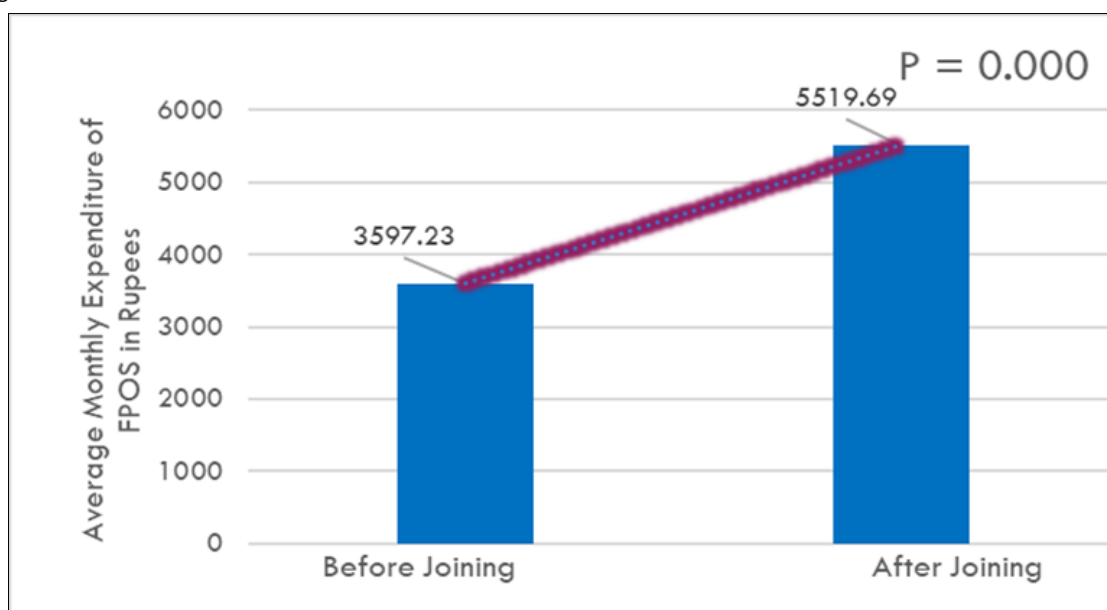


Fig. 3. Change in the monthly expenditure of the FPO beneficiaries.

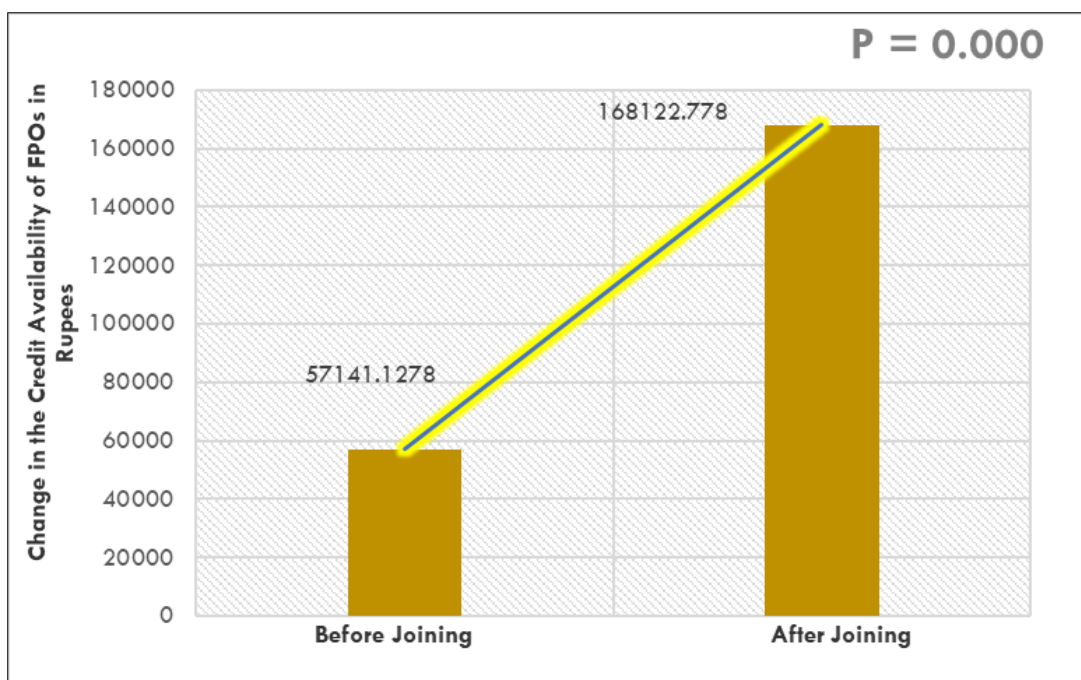


Fig. 4. Change in the credit availability of the FPO beneficiaries.

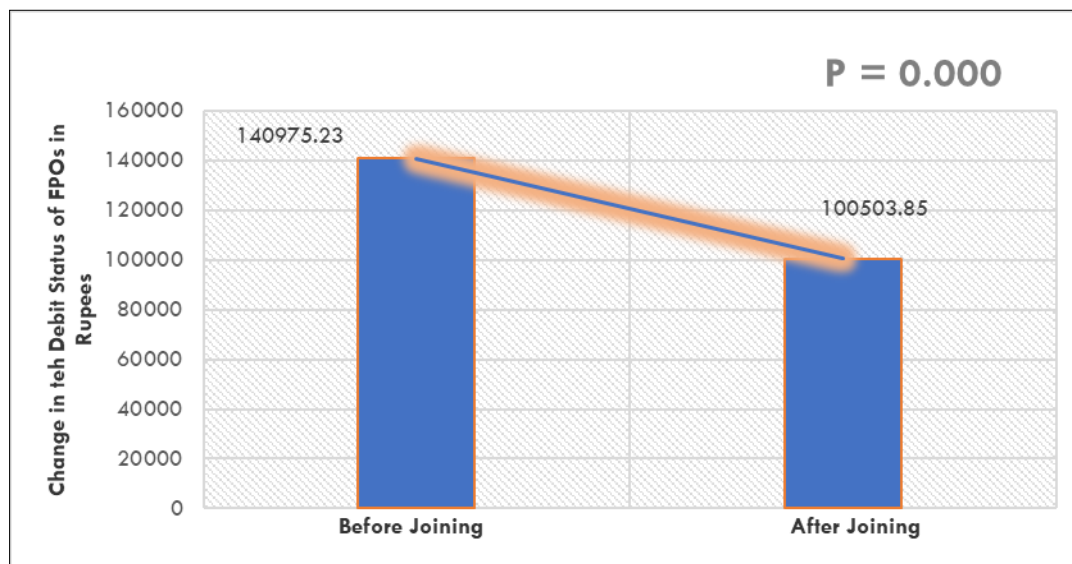


Fig. 5. Change in the debt status of the FPO beneficiaries.

Table 3. Change in the flow of savings of FPO beneficiaries

S. No	Flow of savings	Before joining FPO N = 360	Present status N = 360	‘z’-value	‘p’-value
1	Regular	79 (21.90)	290 (80.60)	13.648**	0.000
2	Irregular	281 (78.10)	70 (19.40)		
	Total	360 (100)	360 (100)		

Statistical test: Wilcoxon signed rank test; Figures in the parenthesis indicates percentages to the total; **Statistically significant at 1 % level of probability

better income streams were some probably factors in this behavioural shift. The significant growth in regular savings of millet growers highlighted the FPOs ability to advance financial inclusion and to strengthen economic security of millet farmers.

From Table 4, it was clear that there has been a significant transformation in the occupational structure of farmers following their participation in millet FPOs. The data illustrated a shift from traditional and subsistence-based livelihoods to more entrepreneurial and diversified income-generating activities (50). Initially, most of the respondents were agriculture dependency (33.33 %), agriculture combined with livestock (30.60 %) and wage earners (22.80 %). However, after associating with FPOs, the proportion of wage earners drastically dropped to 5.30 % and those solely dependent on agriculture reduced sharply to 3.90 %. Likewise, the percentage of individuals involved in agriculture and livestock also declined to 19.20 %. The most remarkable change was observed in the rise of entrepreneurship and business engagement.

Before joining the FPOs, only 9.4 % of the farmers were into business, but this figure surged to 50 % post-FPO intervention with the support of millet FPOs. Similarly, participation in both farming and business activities witnessed a significant increase from 3.90 % to 21.70 %. The statistical validation by Wilcoxon signed-rank test ($z = 14.35$, $p = 0.01$) confirmed that these changes were statistically significant at 1 % probability level. This occupational shift reflected the positive impact of millet FPOs in enabling millet grower to move away from low remunerative roles to more sustainable and millet entrepreneurial ventures. With the support of ICAR-IIMR, Hyderabad these millet FPOs facilitated access to resources like millet seeds, quality inputs, trainings, credit and market linkages to millet growers. Millet FPOs transformed livelihood security and self-reliance ability of millet growers.

A significant change in millet growers’ economic engagement was shown in Table 5. The ‘z’-value for economic activities through Wilcoxon signed-rank test was 14.152, which was

Table 4. Change in the occupational pattern of FPO beneficiaries

S. No	Name of the occupational pattern	Before joining FPO N = 360	Present status N = 360	‘z’-value	‘p’-value
1	Wage earners	82	19	14.35**	0.000
2	Agriculture dependent	120	14		
3	Agriculture & livestock	110 (30.60)	69 (19.20)		
4	Millet business with the help of FPOs	34	180		
5	Farming and business	14	78		
	Total	360	360		

Statistical test: Wilcoxon signed rank test; Figures in the parenthesis indicates percentages to the total; **Statistically significant at 1 % level of probability

Table 5. Change in the economic activity of FPO beneficiaries

S. No	Name of the economic activity	Before joining FPO N = 360	Present status N = 360	‘z’-value	‘p’-value
1	Dairy	14 (3.88)	68 (18.88)	14.152**	0.000
2	Sheep rearing	82 (22.77)	103 (28.60)		
3	Agriculture & allied	230 (63.88)	83 (23.05)		
4	Millet processing	34 (9.44)	58 (16.11)		
5	Millet Aggregation	-	21		
6	Multi millet roti making	-	16		
7	Millet value addition	-	11		
	Total	360 (100)	360 (100)		

Statistical test: Wilcoxon signed rank test; Figures in the parenthesis indicates percentages to the total; **Statistically significant at 1 % level of probability

significant at 1 % LOS with ‘p’-value 0.01. There was a diversification in the economic activities of millet growers after becoming member of millet FPOs leading to the rejection of null hypothesis (51). Table 5 revealed that, before joining millet FPOs millet growers were engaged in economic activities like dairy (3.88 %), sheep rearing (22.77 %), agriculture & allied (63.88 %), millet processing (9.44 %) while after joining millet FPOs results showed diversification of economic activities of millet growers. The landscape of economic activity changed significantly after the FPO intervention. The decrease in engagement in core agriculture to 23.05 % suggested that beneficiaries had benefited from other business activities due to better incomes. In the meantime, participation in jobs involving livestock, such as dairy and goat and sheep rearing, increased to 18.88 % and 28.60 %, respectively. Notably, several new small millet-based enterprises emerged from the millet growers after becoming the members of FPOs. According to the data millet processing (16.11 %), millets aggregation (5.83 %), millet roti making (4.4 %) and millet value addition (3.05 %) was noted. With the support of millet FPOs, this trend clearly showed a shift towards a variety of livelihood options and entrepreneurial endeavours. Beyond improving access to credit and markets, millet FPOs have actively provided training in modern farming practices, financial literacy, processing, value addition and enterprise development. These initiatives have empowered farmers not only to strengthen their primary agricultural income but also to explore alternative income-generating avenues, thereby enhancing resilience, self-reliance and long-term sustainability of rural livelihoods. In addition to increasing income opportunities, this kind of diversification reduced the risks that come with relying solely on one source of income. According to the findings, FPOs have had a major impact on rural economic

dynamics by motivating recipients to engage in a wider range of sustainable millet-based business.

Timely loan repayment was essential for sustainable rural development, alongside access to formal credit. Table 6 highlighted a significant improvement in the loan repayment behaviour of farmers after becoming part of millet FPOs. The change was confirmed with the help of statistical analysis i.e., Wilcoxon signed rank test with $z = 15.16$. The results showed that it was statistically significant at 1 % LOS with ‘p’-value < 0.01 , indicating a meaningful transformation in financial discipline among members. As there was a significant improvement in the credit repayment pattern of millet growers after becoming member of millet FPOs, the null hypothesis was rejected. Before joining the FPO, more than half (over 54 %) of the beneficiaries struggled with irregular loan repayments and only a small fraction (3.6 %) repaid on time. After participating in the FPO, 65.6 % of members indicated that they were repaying their loans on time and their irregular payments were ceased due to the economic activities undertaken by the millet growers through FPOs. Change in repayment habits, propelled by enhanced financial stability, was due to the organized assistance offered through FPO framework (52). FPOs frequently helped its members to obtain formal credit and they also managed the repayment procedures on time. Repaying loans promptly not only boosted farmers’ reliability with lenders but also increased their opportunities in obtaining future finance for expansion and development of business. The change in credit repayment behaviors among FPO members illustrated how collective frameworks enabled farmers to improve their financial responsibility and creditworthiness.

Table 6. Change in the credit repayment of FPO beneficiaries

S. No	Credit repayment	Before joining FPOs N = 360	Present status N = 360	‘z’-value	‘p’-value
1	Irregular	195 (54.20)	-	15.16**	0.000
2	Regular	152 (42.20)	124 (34.40)		
3	On time	13 (3.60)	236 (65.60)		
		360 (100)	360 (100)		

Statistical test: Wilcoxon signed rank test; Figures in the parenthesis indicates percentages to the total; **Statistically significant at 1 % level of probability

Conclusion

Findings from the study decisively illustrated that millet FPOs served as a powerful catalyst for socio-economic transformation among millet growers. Millet FPOs considerably enhanced key livelihood indicators such as employment days, income levels, monthly savings and credit availability during the membership period. In addition, they played an important role in promoting timely credit repayment practices and reducing the overall debt burden of farmers, thereby strengthening their financial security and resilience. The beneficiaries' transition from irregular to regular saving patterns and from traditional wage-based work to entrepreneurial endeavours revealed a more profound change in their economic and behavioural patterns. Through millet businesses, FPO membership also allowed farmers to diversify their revenue streams, lowering their susceptibility to agricultural uncertainties. This progress was further supported by increased institutional support, collective bargaining power and financial literacy with the support of ICAR-IIMR, Hyderabad. Millet FPOs were crucial in helping farmers transition from a subsistence lifestyle to one that offers greater financial security and autonomy by improving income opportunities and financial access. Findings also revealed that all the selected socio-economic variables were statistically significant at 1 % level of significance as confirmed by both the paired sample t-test and the Wilcoxon signed rank test. Furthermore, effect size analysis was carried out, which indicated that most variables showed significance at 1 % LOS and showing the strong impact of millet FPO membership on farmers' livelihoods.

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Authors' contributions

DR and S carried out the research by preparing interview schedule and finalization of data. LB & KC taken the observations from millet growers. DR, S, LB involved in data analysis and report writing. GM and KM collected data and entered data for various parameters. The manuscript was prepared by DR, S, KC and the manuscript was corrected and revised by LB and GM. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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