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Factors affecting method of coffee processing in Visakhapatnam district of Andhra Pradesh

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Abstract
The paper highlights different coffee processing methods adopted by tribal farmers at Paderu division in Visakhapatnam district of Andhra Pradesh. Data collection was done using pre tested questionnaire administrated on 90 coffee producers selected randomly. A Binary logistic regression model was used to determine the factors that influence farmers' willingness to adopt a particular method of processing. Majority of the farmers (65.55%) adopted both sundry + wet processing. The result indicates that processing cost of sundry method was Rs.0.50 per kg clean coffee whereas the processing cost under wet processing was Rs.1.75 per kg clean coffee. The results of binary logistic regression indicate that only water source was significantly determine the choice of method processing. Hosmer-Lemeshow statistics has a significance of 0.078 which means that it is not statistically significant and therefore model is a quite good fit. Variables relationship between areas under coffee, age of farmer, education of farmer, showed the non-significant relationship with the choice of the method of processing. The key constraints to coffee processing are lack of coffee processing facilities, high costs of materials for constructing the raised drying beds, limited technical know-how and long distance to the few processing facilities. Coffee processing can be improved through investment by provision of financial resources to purchase the requisite equipment and training so that the necessary technical, financial and commercial capability would be created for the sustainable management of the coffee processing facilities. The study area located in hilly slopes, during winter season can observe less light hours it was main problem in drying of beans which effects the quality of beans, for overcome this situation to install mechanical dryers may be installed to overcome the adverse situation.

Keywords: Coffee, processing, binary logistic regression

Introduction
Indian coffee is known for the world's best shade-grown 'mild' coffees since most of the coffee cultivation is under shade in India (Coffee Board, 2011) [3]. Coffee was first introduced in Andhra Pradesh in 1898 by Mr. Brodi, a Brtisher in Pamuleru valley in East Godavari district. Subsequently it spread over to Pullangi (East Godavari district), Araku Valley and Gudem of Visakhapatnam agency tracks. In 1920s it was spread over to Ananthagiri in Araku valley and Chintapalli areas (Indian coffee, 2015) [9].
Quality of coffee is referred in respect to color, size, appearance, and flavor with acidic aroma. The quality of the final product depends upon the pre-harvesting and posts harvesting activities. At the post-harvest level, practices adopted like sorting, pulping, fermentation, washing, drying, storage, packing and processing including hulling and grading activities have a direct bearing on the final quality of coffee (Venkatesh KB, 2011) [18].
Coffee is produced either by dry processing or by wet processing. After harvesting, the coffee fruits are separated from the pulp, which is carried out by dry or wet processing (Clarke & Macrae 1987; Illy & Viani 1995) [2, 8]. The dry process is simple and inexpensive. The whole cherries are dried under the sun in open air, followed by the separation of the hull (dried pulp and parchment) for getting the green beans. On the contrary, the wet process requires more care and investment, but results in a superior coffee quality (Bytof *et al.* 2004) [1]. In the wet process, the pulp of the coffee cherries, which is made up of exocarp and mesocarp, is removed mechanically, but the parchment remains attached to the beans. After drying either under the sun or in a dryer, the parchment is removed to produce the green coffee beans (Ghosh P, 2014) [7]. Objective of the study was conducted to identify processing methods and factors affecting choice of method of processing.

Methodology
The study was conducted in Andhra Pradesh during the year 2016-17. Multistage random sampling design was used for the study. Paderu division was purposively selected as coffee is extensively cultivated in this division.

This division occupies first place both in area and production in Visakhapatnam district. Six mandals namely G. k. veedhi, Chintapalli, G. madugula, Paderu, Hukumpeta and Dumriguda were purposively selected as they occupy the first six positions in area under coffee. Three villages from each mandal were selected based on highest area under coffee plantation. The coffee growing tribal farmers of the selected villages were listed in each village along with their operational holding and arranged in descending order and five coffee growing tribal farmers were randomly selected to make a sample of 90 respondents for the study.

Binary Logistic Regression

A Binary logistic regression model was used to determine the factors that influence farmers' willingness to adopt a particular method of processing. The use of binary logistic regression model gives the maximum likelihood.

Thus:

$$P_i = F(Z_{i)} = F(\alpha+\beta X_i) = \frac{1}{(1+\exp(-Zi))} \ldots\ldots (1)$$

Where:

F (Zi) the standard normal density function for the possible values of the index *Zi*;

P_i the probability of method of processing

X_i set of explanatory variables

α= regression intercept, and

β= a vector of coefficient

Where i = 1, 2, 3, ...n

Where P_i is the probability that an individual willing to participate in the method of processing, given X_i (the explanatory variables) and are parameters to be estimated. The log odds of the probability that an individual is willing to adopt a method of processing is given by

$$Z_i = \log\left(\frac{Pi}{1-Pi}\right) = \alpha + \beta_i X_i + \ldots \beta_n X_n + E \ldots. (2)$$

Where:

i =1, 2 …. N is observations

Z_i the natural logarithm of choice for the i^{th} observation

X_n the nth explanatory observation

E= the error or disturbance term.

The dependent variable is a binary variable representing the willingness to participate (1 for wet processing and otherwise 0). Independent variables included are farmers' socio-economic characteristics such as age, educational level, farm size and water source. For this study, the above equation is expressed implicitly as

$$WTM = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + u_i$$

WTM = The method of processing (1 for wet processing and otherwise 0)

X_1 = Age of household head (years)

X_2 = Level of education of household head (years spent in school)

X_3 = Farm size (ha)

X_4 = Water source (1 for availability and otherwise 0)

b_1, b_2 . . . b_4 are parameters corresponding to estimated variables' coefficients.

u_i is the error term and consists of unobservable random variables.

Result and Discussion

Processing of coffee involves performing a series of mechanical or chemical operations in order to change or preserve it. The quality of coffee is determined 40.00 per cent in the field, 40.00 per cent at post-harvest primary processing and 20.00 per cent at secondary processing. The similar findings in line of Richard *et al.* (2007) [14]. Quality and market value of coffee improved by primary processing at farmers level is a prerequisite, an improvement in coffee quality and therefore income has a direct impact on the livelihood of a large number of rural populations especially coffee growers. Keeping this in view, an attempt has been made to examine and evaluate different methods of coffee processing.

Methods of Processing of Coffee: There are two main processing methods, *viz.* sundry or natural dry and wet processing or washed coffee of Coffee is processed either by wet method to produce parchment coffee or dry method to obtain cherry coffee. These finding are similar with Daniels (2009) [4], Sualeh *et al.* (2014) [15], Woldsenbet *et al.* (2015) [20].

Adoption of different methods of Processing: The number of farmers adopting different methods of processing is presented in Table 1 and depicted in Fig 1

Table 1 indicates that 65.55 per cent of famers adopted sundry +wet processing. Only 34.44 per cent of the farmers adopted sundry processing method and none of them adopted wet processing method alone.

Table 1. Number of farmers adopting different methods of coffee processing

S. No.	Method of processing	Number	Percentage
1	Sundry only	31	34.44
2	Wet processing only	0	0
3	Sundry + Wet processing	59	65.55

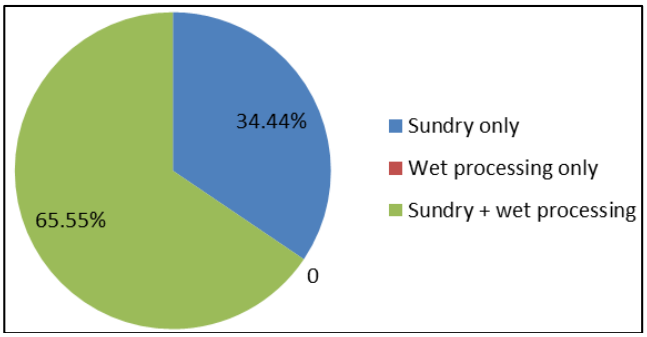

Fig 1: Farmers adopting different methods of coffee processing

Advantages and Disadvantages of Wet and Dry coffee Processing Methods: Choice between wet and dry coffee processing methods depends largely on farmers understanding of the advantages and disadvantages of the technology and the factors responsible for the choice of methods of processing. Based on opinion of the respondents, advantages and disadvantages of processing methods are presented in Tables 2 and 3.

Advantages and disadvantages of wet processing: It can be seen from the tables 2 and 3 that all the farmers (100%) expressed that wet processing is advantageous because the coffee generated by this method fetched higher price Rs.160/kg and good quality compared to coffee generated by

sun dry method which was sold at Rs.65/kg. These findings are similar with Wickrama singhe (2001) [19], Bytof *et al.* (2004) [1], Deoju and Manandhar (2004) [5], Knopp *et al.* (2005) [11], Kattel (2009) [10]. Other advantages of the wet processing include quick coffee drying (2- 4 days) reported by (94.70 per cent), while 92.5 per cent of the respondents reported that wet coffee processing was labour intensive. These findings were similar in line of Wickrama singhe (2001) [19]. This was the major disadvantage in wet processing. Wet processing includes cherry pulping, fetching water for coffee processing, cherry sorting and drying. These findings were similar in line of Subedi (2011) [16].

Advantages and disadvantages of sun dry: It can be observed from the tables 2 and 3 indicates that 85.7 per cent of respondents opined sundry method not expensive and less labour intensive are the major advantages in sundry method. These findings were similar in line of Musebe *et al.* (2007) [13]. 93.32 per cent of the respondents reported generating coffee to this method fetches a lower price and 75.00 per cent of the respondents opined drying takes a long time about 10 - 12 days. These are the major disadvantages in sundry method.

Table 2. Advantages of wet and dry processing methods

S. No.	particulars	Wet method (percentage)	Sundry method (percentage)
1	Higher price	100.00	-
2	Quick coffee drying	94.70	-
3	Clean coffee generated	86.00	-
4	Coffee management training	84.20	-
5	Access to credit	68.40	-
6	Less time consuming	63.30	
7	Not expensive	-	85.70
8	Less labour intensive	-	85.00

Table 3. Disadvantages of wet and dry processing methods

S. No.	Particulars	Wet method (percentage)	Sundry method (percentage)
1	Labour intensive	92.51	-
2	Expensive	84.12	-
3	Delayed payment	35.20	-
4	Low price	-	93.32
5	Long time of drying	-	75.00
6	Generated coffee less clean	-	53.30

Choice of Method of Processing: In the study area, all the farmers were adopting both the processing methods *viz.* sun dry and wet processing. These finding was similar in line of Sualeh *et al.* (2014) [15]. Adoption of method of processing mainly depends on 1) Availability of water 2) Availability of skilled labour 3) Immediate need of money. The choice of method processing is presented in Table 4.

Table 4. Preference of method of processing

S. No.	Quantity (kg)	Sundry (kg)	Wet method (kg)
1	1000	600 (60%)	400 (40%)

The table 4 reveals that 60 per cent of fresh fruit berries (FFB) were processed through sundry method, while 40 per cent of fresh fruit berries were through wet processing. These finding was similar in line of Musebe *et al.* (2007) [13]. In sundry method, farmers fetch lower price for their produce even though the major quantity of FFB were processed through sundry method due to non-availability of plenty of water and non-availability of labour. Wet processing is adopted for removing the pulp with hand pulper within 5 to 6 hours after harvest.

Method of Drying: Both the processing methods require drying operations. Drying methods followed by sample farmers is spread on ground and cement floor presented in Table 5 and Fig 2. These finding similar in line of Garo *et al.* (2016) [16].

Table 5. Method of drying practiced by farmers

S. No.	Method of drying	Number	Percentage to total
1	Spread on ground	15	16.67
2	Cement floor	75	83.33
	Total	90	100.00

About 83.33 per cent of coffee farmers dry their coffee on cement floor, while 16.67 per cent of the farmers dry their coffee by spreading on ground (Table 5).

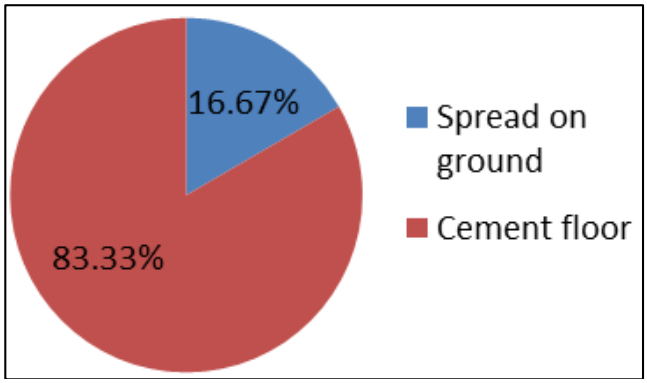

Fig 2: Drying of coffee

Processing Cost: The processing cost per kg of clean coffee is presented in Table 6.

Table 6. Processing cost of coffee

S. No.	Particulars	Sundry (Rs. /kg)	Wet processing (Rs. /kg)
1	Pulping	0.00	1.00
2	Cleaning	0.00	0.5
3	Drying	0.5	0.25
4	Total	0.5	1.75

It can be observed from the table 6 that cost of wet processing of clean coffee was Rs.1.75 per kg while sundry processing was Rs.0.5 per kg of clean coffee. It is also revealed that the sun drying method had the lowest cost but produced coffee of inferior quality compared to wet processing. This finding was similar line of Musebe *et al.* (2007) [13].

Variables Influencing Method of Coffee Processing: The choice of processing method to use for coffee depends on a number of factors. Among them, area under coffee, age of farmer, education experience and water source are important. In order to determine the factors that significantly affect choice of the processing method, a binary logistic regression model was used. The dependent variable, processing method is a binary variable with 0 representing sundry processing and 1 representing wet processing method. The result from binary logistic regression was presented in Table 7. Perusal of table 7 indicated that only water source significantly determined the type of processing method to be used. Variables relationship between area under coffee, age of farmer,

education of farmer, showed the non-significant relationship with the choice of the method of processing.

Table 7. Variables influencing method of processing of coffee

S. No.	Variables	Co-efficient	Standard error	p-value
1	Age of farmer	0.03	0.02	0.895
2	Area under coffee	-0.03	0.06	0.640
3	Education level	-0.01	0.18	0.995
4	Water source	0.93	0.45	0.039*
5	Constant	-0.90	1.26	0.474
6	Chi-square (Hosmer-Lemeshow)	4.770		0.078

*Significant at 5% level

It is clear from the above discussion that 60.00 per cent of Fresh Fruit Berries (FFB) was processed through sundry method while 40.00 per cent were through wet processing. Dry method of coffee processing was simple and low cost with few handling steps. Processing cost of sundry method was Rs.0.50 per kg clean coffee, whereas the processing cost under wet processing was Rs.1.75 per kg clean coffee. About 83.33 per cent of coffee farmers dry their coffee on cement floor, while 16.67 per cent of the farmers dry their coffee by spreading on ground.

Water source was significantly determining the choice of method. These findings were similar line of Musebe *et al.* (2007) [13]. Sundry processed produces had low quality coffee fetching lower prices whereas, wet processing methods consisting of more handling steps produces high quality coffee fetching higher prices. These findings were similar line of Kattel (2009) [10], Tiwari (2009) [17]. More quantity of FFB under wet processing is mainly based on availability of water source, and it is the only variable that influenced the choice of method of processing. Hosmer-Lemeshow statistics has a significance of 0.078 which means that it is not statistically significant and therefore model is a quite good fit.

Conclusion

The study pointed out that due to lack of water source majority of the coffee growers adopting sundry processing method even they knew it generates less marketing price. Water source was significantly determining the choice of method. It produces low quality coffee fetching lower prices whereas, wet processing methods consisting of more handling steps produces high quality coffee fetching higher prices. More quantity of FFB under wet processing is mainly based on availability of water source, and it is the only variable that influenced the choice of method of processing. Wet processed beans have more market price than sun processed bean. Hence facilities may be providing for establishing motorized pulping unit and washing stations so as to get additional income. The study area located in hilly slopes, during winter season can observe fewer light hours it was main problem in drying of beans which affects the quality of beans, for overcome this situation need to install mechanical operators to overcome the adverse situation.

Reference

1. Bytof G, Knopp SE, Schieberle P, Teutschlselmar D. Influence of processing on the generation of -aminobutyric acid in green coffee beans. Eur. Res. Technol. 2004; 220:245-250.
2. Clarke RJ, Macrae R. Coffee London: Elsevier Applied Science. 1987.
3. Coffee Board of India. 2011. Database on Coffee, March 2011. www.indiacoffee.org.
4. Daniels N. Variations in coffee processing and their impact on quality and consistency. A Report Submitted in partial fulfillment of the requirements for the degree of Master of Science in forestry Michigan technological university 2009.
5. Deoju LN, Manandhar S. An overview of specialty coffee. tea and coffee development section, Kirtipur, Kathmandu, Nepal. 2004.
6. Garo G, Shara S, Yohanes Y. Assessment of harvest and post-harvest factors affecting quality of Arabica coffee in GamoGofa Zone, Southern Ethiopia. African Journal of Agricultural Research. 2016; 11(24):2157-2165.
7. Ghosh P, Venkatachalapathy N. Processing and drying of coffee– a review. International Journal of Engineering Research & Technology. 2014; 3(12):2278-2281.
8. Illy A, Viani R. Espresso Coffee: The Chemistry of Quality Londres, UK: Academic Press. 1995.
9. Indian coffee magazine, November. 2015.
10. Kattel RR. The impact of coffee production on nepali smallholders in the coffee value chain. M. Sc. Thesis submitted to Institute for Environmental Economics and World Trade, Leibniz University Hannover, Germany. 2009.
11. Knopp S, Bytof G, Selmar D. Influence of processing on the content of sugars in green Arabica coffee beans. European Food Research Technology. 2005; 223:195-201.
12. Munankami R. Analysis of quality management practices in coffee supply chain in kavrepalanchowk district, Nepal. A research project submitted to Larenstein University of Professional Education, Deventer, Netherlands. 2004.
13. Musebe R, Agwanda C, Mekonen M.x Primary coffee processing in Ethiopia: patterns, constraints and determinants. African Crop Science Conference Proceedings. 2007; 8:1417-1421.
14. Richard M, Charles A, Mitiku M. Primary coffee processing in Ethiopia: Patterns, constraints and determinates. Afr. Crop Sci. Conf. Proceed. 2007; 8:1417-1421.
15. Sualeh S, Endris S, Mohammed A. Processing method, variety and roasting effect on cup quality of arabica coffee (*Coffea arabica* L.). Journal of Agriculture and Food Sciences. 2014; 2(2):70-75.
16. Subedi RN. Comparative analysis of dry and wet processing of coffee with respect to quality and cost in kavre district, Nepal: a case of panchkhal village. International Research Journal of Applied and Basic Sciences. 2011; 2(5):181-193.
17. Tiwari HB. Value chain development of coffee in Nepal. Paper presented at a seminar on coffee development organized at Tea and Coffee Development Section, Department of Agriculture, Kirtipur. 2009; 9-10.
18. Venkatesh KB, Bokelman w. Value chain analysis for coffee in Karnataka, India. M.Sc thesis. 2011.
19. Wickramasinghe PJ, Gunaratne WD, Senanayake SM. Coffee: Cultivation and processing. Department of export agriculture, ministry of agriculture, lands and forestry, Sri Lanka. 2001.
20. Woldesenbet AS, Woldeyes B, Chandravanshi BS. Wet coffee processing waste management practice in Ethiopia. Asian journal of science and technology. 2015; 6(5):1467-1471.