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Component structure of women role in goat rearing

K K TYAGI[1], M D PATEL[2], L M SORATHIYA[3] and A B FULSOUNDAR[4]

Navsari Agricultural University, Navsari, Gujarat 396 450 India

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ABSTRACT

The component structure of 25 Likert-type variables measuring different aspects of role of women in goat rearing was investigated using principal components analysis (PCA) with varimax orthogonal rotation. The respondents were 225 goat farmers from 6 clusters adopted under All India Coordinated Research Project on Goat improvement (AICRP-G) - Surti Field Unit. Finally 13 Likert-type variables were retained after stepwise exclusion of inappropriate variables from analysis. The Kaiser–Meyer–Olkin measure verified good sampling adequacy for the analysis, KMO = 0.847. Bartlett's test of sphericity χ^2 (78) = 1878.40, indicated that correlations between items were sufficiently large for PCA. On the basis of parallel analysis and Kaiser's criterion, a 2-component structure was found, from which 2 subscales (outdoor roles and indoor roles) with reliabilities of 0.872 and 0.876 explaining 62.01% of the variance were extracted using PCA. Present study elucidated social perceived agreement on outdoor and indoor roles of women in goat rearing as 2 major principle components. Furthermore baseline information on retained and excluded variables by PCA and Reliability statistics will foster future studies to understand role of women in goat rearing more closely.

Key words: Goat, Parallel analysis, Principal components analysis, Reliability, Women role

The role of livestock in rural communities is changing rapidly. Goats form an important component of livestock industry and play a vital role in the socio-economic structure of rural poor. Although the operations related to animal husbandry and management is jointly carried out by all the family members, the goats are specifically managed by spare family members i.e. women, old persons and even children due to its easy handling (Gurjar and Pathodiya 2006). Nowadays women are playing multifaceted roles in goat rearing measurable on Likert agreement scale. Despite this known fact hardly any study investigated principal components of women role in goat rearing agreed upon by society. Principal component analysis (PCA) is a multivariate ordination technique used to display patterns in multivariate data. It aims to graphically display the relative positions of data points in fewer dimensions while retaining as much information as possible, and explore relationships between dependent variables. Present study is an effort to extract principal component structure of women role on an agreement scale and to elucidate underlying relationship between variables.

Present address: [1-3]Assistant Research Scientist (naulrs @gmail.com, drmanish911@yahoo.com, lmsorathiya @yahoo.co.in), [4]Research Scientist (abfulsoundar@gmail.com), Livestock Research Station.

MATERIALS AND METHODS

The data was collected from 225 goat owners in 6 clusters operational under All India Co-ordinated Research Project (AICRP) on goat improvement –Surti field unit, running at Livestock Research Station, Navsari Agricultural University, Gujarat. Five point agreement scale 1= strongly disagree, 2= disagree, 3= neither, 4= agree and 5= strongly agree (Likert 1932) was used in present investigation. Responses on 25 Likert-type variables measuring different aspects of role of women in goat rearing were collected using pre structured questionnaire (Table 1).

The factor programme of SPSS (2001) statistical package was used for the PCA. Suitability of number of components to be retained was adjudged by parallel analysis (PA) using ViSta software (Ledesma and Valero-Mora 2007). The determinant of the correlation matrix was used to test for multicollinearity and singularity. Kaiser-Meyer- Olkin (KMO) measures of sampling adequacy and Bartlett's Test of Sphericity (BTS) were computed to test the validity of the factor analysis of the data sets. PCA and PA were run multiple times till satisfactory values of above stated statistical tests were obtained by stepwise exclusion of inappropriate variables from analysis. The varimax criterion of the orthogonal rotation method was employed in the rotation of the factor matrix to enhance the interpretability of the principal components. Finally, component structure

Table 1. Likert-type variables measuring different aspects of women's role in goat rearing

Variable Number	Women play role in	Mean±SEm
1	Grazing of goats	4.29±0.04
2	Care of Kids	4.32±0.05
3	Post parturient care of goats	3.91±0.08
4	Herbal medication to goats	3.22±0.08
5	Feed gathering for goats	3.44±0.06
6	Selling of goats	4.04±0.06
7	Share earnings from goats	3.72±0.08
8	Concentrate making for goats	3.91±0.06
9	Goat house making	3.26±0.10
10	Supplementary feeding after grazing	3.32±0.09
11	Cleaning goat shed	4.36±0.07
12	Sick goat care	4.06±0.08
13	Estrus detection in goats	2.37±0.08
14	Watering goats	4.11±0.08
15	Economic upliftment	3.71±0.08
16	Selecting buck	3.99±0.07
17	Assisting parturition in goats	3.96±0.08
18	Milk vending	3.18±0.08
19	Cleaning goats	4.05±0.06
20	Milking of goats	3.82±0.08
21	Purchase of goats	4.08±0.07
22	Pregnant doe care	3.91±0.08
23	Dung disposal	3.74±0.07
24	Parasite control in goats	3.28±0.08
25	Social participation vis-à-vis goat rearing	3.58±0.09

so obtained was subjected to reliability analysis (RA). Possible enhancement of Reliability was obtained by deleting offending variables based on Cronbach's α values. Final PCA was carried out on remaining variables to elucidate principal component structure of women role and underlying relationship between variables.

RESULTS AND DISCUSSION

Mean score of 25 Likert-type variables measuring different aspects of role of women in goat rearing have been presented in Table 1. All the variables except variable number 13 depicting role of women in estrus detection were having mean score greater than 3. This signifies social acceptance about women's role in goat rearing on almost all the variables except estrus detection in does. Maximum mean score was obtained for variable 11 depicting major involvement of women in cleaning of goat sheds. Similar results with 82% responses in favour of involvement of women in cleaning of goat sheds were observed among Surti goat farmers (Deshpandey and Sabapara 2010). Data reduction and exclusion of inappropriate variables to obtain optimal data set using various statistical tests is presented in Table 2. Analysis was run five times before getting optimal data set. Correlation matrix was scanned for variables with smallest number of correlations $r \geq 0.3$ to be left out from analysis on each run (Field 2009). First variables to be left out from analysis were 17 and 19 representing assisting parturition in goats and cleaning goats respectively. The highest correlation obtained for these variables were 0.1 and 0.2 respectively, representing the fact that these were not significantly contributing to PCA. Similarly variable number (3), (10, 24) and (9, 13, 15 16) were left subsequently on second, third and fourth run respectively based on ascending order of number of correlations $r \geq 0.3$ exhibited by them. Numbers of components to be retained on each run of parallel analysis were 5, 5, 3, 4 and 2 respectively. Determination of number of components using parallel analysis had been recommended over other available methods like Kaiser's criterion and Scree plot (Zwick and Velicer, 1986). Decrease in number of components after excluding inappropriate variables on each run had enhanced interpretability of results. KMO measures of sampling adequacy were 0.788, 0.794, 0.811, 0.811 and 0.847 in subsequent runs. KMO values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great and values above 0.9 are superb (Hutcheson and Sofroniou, 1999). Increase in KMO value indicates augmentation of sampling adequacy by exclusion of inappropriate variables on each run. Although BTS values decreased on each run but they were sufficiently higher enough (P=0.00) to validate factor analysis for data set. Determinant value reached above required value of 0.00001 on fifth run indicating adequate data set with no multicollinearity problem.

Variable number 1, 4, 5, 8, 18, 21 and 25 clustered on component 1 representing subscale 1, whereas 2, 6, 7, 11, 12, 14, 20, 22 and 23 got clustered on component 2 representing subscale 2 in factor loadings of varimax rotated

Table 2. Data reduction and exclusion of inappropriate variables

Run	VR	VL	CR	KMO	BTS	D	Variables left out for next analysis
1	25	0	5	0.788	3215.72	3.16E-07	17, 19 (Zero correlation, r > 0.3)
2	23	2	5	0.794	3154.22	4.40E-07	3 (One correlation, r > 0.3)
3	22	3	3	0.811	2965.22	1.08E-06	10, 24 (Two correlations, r > 0.3)
4	20	5	4	0.811	2675.32	4.30E-06	9, 13, 15, 16 (Three correlations, r > 0.3)
5	16	9	2	0.847	2154.47	5.07E-05	None

VR= variables retained for analysis, VL= Variables left out from analysis, CR= Components retained for analysis, KMO= Kaiser–Meyer–Olkin measure, BTS= Bartlett's test of sphericity, D= Discriminant of correlation matrix, r= Correlation coefficient

Table 3. Reliability statistics of two extracted subscales

Variable number	Cronbach's α, if variable deleted				
	Before deletion		After first deletion		After second deletion
	Subscale 1 Overall α = 0.853	Subscale 2 Overall α = 0.869	Subscale 1 Overall α = 0.863	Subscale 2 Overall α = 0.876	Subscale 1 Overall α = 0.872
1	0.827		0.839		0.856
2		0.858		0.868	
4	0.863		Deleted		
5	0.832		0.847		0.863
6		0.860		0.87	
7		0.876		Deleted	
8	0.850		0.872		Deleted
11		0.866		0.877	
12		0.852		0.857	
14		0.831		0.838	
18	0.809		0.815		0.818
20		0.849		0.855	
21	0.831		0.845		0.865
22		0.843		0.851	
23		0.855		0.864	
25	0.807		0.810		0.806

solution. Cronbach's alpha, a statistical measure of how well a set of items are interrelated, was used to assess two subscales. Reliability analysis of these two subscales has been presented in Table 3. Factors are considered reliable when the Cronbach's α values are 0.7 or higher (Kline 1999). The overall Cronbach's α value were 0.853 and 0.869 for subscale 1and 2, both values reflecting good degree of reliability. The Cronbach's α, if a particular variable is left from analysis exposed variable 4 and 7 as worst offenders on subscales 1 and 2. Deleting these variables enhanced Cronbach's α value to 0.863 and 0.876 for subscale 1and 2. However in subscale 1, variable number 8 exposed as new offender and deleting this augmented Cronbach's α to 0.872. Deleting variable number 11 in subscale 2 would increase the Cronbach's α from 0.876 to 0.877. Nevertheless this increase was negligible and both values reflect a good degree of reliability. Therefore, Cronbach's α value of 0.872 and 0.876 was obtained after deleting offending variables 4, 8 from subscale 1and variable 7 from subscale 2.

Principal component analysis (PCA) was finally conducted on the 13 items with orthogonal rotation (varimax). The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO =0. 847 (great according to Field 2009), and all KMO values for individual items were > 0.752, which was well above the acceptable limit of 0.5 (Field 2009). Bartlett's test of sphericity χ^2 (78) = 1878.40, P <0.001, indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigen values for each component in the data. Two components had eigen values over Kaiser's criterion of 1 and in combination explained 62.01% of the variance. Similarly two component structures were obtained using parallel analysis. Given the Kaiser's criterion and parallel analysis on two components, this is the number of components that were retained in the final analysis. Communalities and factor loadings after rotation are presented in Table 4. Communality is the extent to which an item correlates with all other items. Higher communalities are better. Variable will struggle to load significantly on any factor if communalities for a particular variable are low (between 0.0–0.4). In present study except variable number 11, communalities of finally selected 12 variables were well above 0.4, hence contributing significantly towards factor loadings. However variable 11 cleaning of goat sheds also

Table 4. Communalities and factor loadings after varimax rotation

Component	Variable No.	Communalities	Component loadings	
			1	2
1	25	0.776	0.864	0.172
	18	0.734	0.842	0.160
	1	0.702	0.820	0.172
	21	0.583	0.748	0.152
	5	0.551	0.730	0.130
2	22	0.780	0.046	0.882
	14	0.784	0.271	0.843
	2	0.632	–0.052	0.793
	20	0.604	0.240	0.739
	12	0.591	0.457	0.619
	11	0.344	0.238	0.536
	23	0.529	0.509	0.519
	6	0.451	0.471	0.478

fits well based on reliability analysis in present study. Maximum communality was shown by variable depicting role of women in providing drinking water to goats. Communalities for the women's role in goat rearing indicated the two factors explained more than 70% of the variances in social participation, grazing, pregnant doe care, milk vending and watering. However, the 2 factors explained 60–70% of the variance in care of kids, milking and less than 60% variance for rest of the variables.

The items that cluster on the same components suggest that component 1 represents outdoor and component 2 represents indoor roles of women in goat rearing. The first component was termed outdoor roles because it had high positive loadings for social participation, milk vending, grazing, purchase and feed gathering. All these variables call for movement of women outside their house territory. Variables that score high on second component were pregnant doe care, watering, care of kids, milking does, sick goat care, cleaning goat shed, dung disposal and selling of goats. All these variables depicts in-house involvement of women in goat rearing and hence the name "Indoor roles". Similar involvement of women in many operations both in the farm and outside the farm were reported in different agro-climatic zones of Karnataka (Ramesh and Meena 2012). Present studies elucidated social perceived agreement on outdoor and indoor roles of women in goat rearing as two major principle components. Furthermore, baseline information on retained and excluded variables by PCA will foster future studies to understand role of women in goat rearing more closely.

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