Morphological Traits of Pubertal and Pregnant Frieswal Heifers Under Field Conditions

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ABSTRACT

Present study was conducted in U. S. Nagar district of Uttarakhand on 131 Frieswal heifers reared by 127 farmers under 5 AI centres to study the farmers profile and factors affecting on morphological traits of Frieswal heifers. Data on socioeconomic characteristics were collected from the farmers using questionnaire. Body measurements were taken when the animal was standing comfortably and evenly on her feet on hard plain ground. Maximum of the respondents were educated (73.23 %), owned small herd size of 3AUE (44.09 %), possessed up to 5 acres land (44.09 %) and very few (23.62 %) were landless. Least-squares means (cm) of 47 pubertal and 62 pregnant heifers were 118.7 ± 1.7 and 134.1 ± 1.9 for BL, 114.5 ± 1.3 and 121.3 ± 1.2 for HAW, 143.1 ± 2.3 and 162.7 ± 2.4 for CG, 150.9 ± 3.0 and 173.5 ± 3.0 for PG, 41.0 ± 0.9 and 43.8 ± 0.9 for FL, 29.7 ± 0.9 and 31.7 ± 0.9 for FW, 17.4 ± 0.3 and 19.1 ± 0.4 for EPL, 67.3 ± 1.2 and 70.3 ± 1.1 for HE, 33.6 ± 0.8 and 37.3 ± 1.2 for HK, 109.1 ± 1.2 and 115.0 ± 1.2 for HPB, 112.6 ± 1.4 and 119.6 ± 1.1 for HHB, 3.08 ± 0.07 and 3.83 ± 0.07 m^2 for BSA, 5.15 ± 0.23 and 5.62 ± 0.24 mm for SFT and 227.0 ± 9.3 and 331.7 ± 10.9 kg for EBW, respectively. Land holding had significant effect on HAW, HE and HK in pubertal heifers. Whereas, stage of gestation had significant effect on BSA, SFT and EBW in pregnant heifers.

Keywords: Farmers profile, pubertal and pregnant frieswal heifers, morphological traits

The livestock sector alone contributes nearly 25.6% of Value of Output at current prices of total value of output in Agriculture, Fishing and Forestry Sector. The overall contribution of Livestock Sector in total GDP is nearly 4.11% at current prices during 2012-2013 (Livestock Census, 2012). The state of Uttarakhand is located in Western Himalayan region and is one of the geographically smallest state of the country. Agriculture is a predominant sector in the state economy. Livestock farming acts as a store of wealth, as insurance in times of agricultural crisis and as instrument of socio-economic development, particularly for small holders and the landless labours. The livestock sector in the state providing livelihood to majority of the people as it is rain fed area with low productivity (Pundir *et al.* 2014). Crossbreeding has been widely used due to its outstanding results to improve the genetic potential of indigenous cattle in last few decades. Project Directorate on Cattle, Meerut is involved in developing a new breed of cattle "Frieswal" utilizing HF and Sahiwal breed in collaboration with Ministry of Defence with an exotic inheritance between 37.5 and 62.5%. Various studies

have been undertaken to investigate the production potential of crossbred cattle which is being evolved using indigenous and exotic breeds (Singh *et al.* 2000). Body size and body measurements traits of an animal are associated with the productivity and have an important role in input output relationship (Shankar and Mandal, 2010). Information on morphological traits of crossbreds cattle under field conditions are, however scanty. Hence, present investigation was undertaken to study the morphological traits of pubertal and pregnant Frieswal heifers under field conditions.

MATERIALS AND METHODS

In the present study the experimental work were conducted on Frieswal heifers. A total of 42 pubertal and 62 pregnant Frieswal heifers, available with farmers were covered in 30 villages under 5 AI centres viz. Pantnagar, Gadarpur, Bazpur, Kicha and Sitarganj under field progeny testing programme in U. S. Nagar district of Uttarakhand. Data were collected from the farmers by using questionnaire. Eleven body measurements namely body length (BL), height at withers (HAW), chest girth (CG), paunch girth (PG), face length (FL),face width (FW), ear pinna length (EPL), height at elbow (HE), height at knee (HK), height at pin bone (HPB), height at hook bone (HHB) were taken from heifers with utmost precision to the nearest centimetre on each animal and body weight were estimated using Shaeffer's formula. Body surface area (BSA) was calculated from estimated body weight (EBW) by using Brody's formula (Brody, 1945). Skin fold thickness (SFT) were measured from flank area of heifers by using digital callipers by exerting uniform pressure. Effects of socio economic factors like education level, herd size and land holding pattern of farmers on morphological traits of Frieswal heifers were studied.

Education level was categorized into four groups and specific codes were given viz., illiterate-1, read and write-2, matriculate-3 and more than matriculate-4.

Herd size was categorized into four group viz., up to 3 AUE (Animal unit equivalent)-1, 3 to 6 AUE-2, 6 to 12 AUE-3 and more than 12 AUE-4. Units for different category of animals (cattle) are as follows:-Adult - 0.800, Immature (heifer)-0.600 and Young (calf) - 0.260 (GOI, Animal Husbandry Statistics, 2011).

Similarly, land holding were categorized into four groups and codes were given accordingly as landless-1, small-2, medium-3 and large-4, respectively. The data on morphological traits of heifers were subjected to least-squares analysis of variance as per Harvey (1987) using PC version.

RESULTS AND DISCUSSION

Farmers' profile

A total of 127 farmers covered under 5 AI centres of U. S. Nagar district were approached to collect and study the information related to their on education level, herd size and land holding (Table 1). All the farmers reared Frieswal heifers born under All India Co-ordinated Research Project (AICRP) in Frieswal (Progeny Testing Unit).

Education level

Out of 127 respondents, about 26.77% of farmers were illiterate, 25.98% are able to read and write, 17.32% had matriculation and 29.92% of farmers had education level more than matriculate. Present findings indicated that rearing of Frieswal cattle is mostly done by educated people in this area. Present finding is in close agreement with those reported by Prasad (2003) and Sharma and Singh (2003) in Udham Singh Nagar district of Uttarakhand.

Table 1: Farmers' profile (Respondents = 127)

Sl. No.	Particulars	Level	Observation	%
1	Education level	1 (Illiterate)	34	26.77
		2 (Read and write)	33	25.98
		3 (Matriculate)	22	17.32
		4 (> Matriculate)	38	29.92
2	Herd size	1 (Up to 3 AUE)	65	51.18
		2 (3 to 6 AUE)	43	33.86
		3 (6 to 10 AUE)	13	10.24
		4 (> 10 AUE)	6	4.72
3	Land holding	1 (Landless)	30	23.62
		2 (Small – up to 5 acres)	56	44.09
		3 (Medium - 5 to 10 acres)	18	14.17
		Here, AUE denotes Animal Unit Equavalent		

Table 2. Least-squares means for morphometric traits in Frieswal heifers at puberty (606.1±21.0days)

Effects	Code	Obs.	BL	HAW	CG	PG	FL	FW	EPL	HE	HK	HPB	HHB	BSA	SFT	EBW
Education	1	12	120.6 ±3.1	115.5 ±2.3	140.7 ±4.1	150.1 ±5.4	41.4 ±1.7	31.2 ±1.6	16.9 ±0.5	68.3 ±2.1	33.5 ±1.5	110.2 ±2.3	113.9 ±2.5	3.07 ±0.13	5.32 ±0.42	220.6 ±16.7
	2	12	120.5 ±3.1	113.9 ±2.3	140.9 ±4.2	147.6 ±5.5	39.2 ±1.7	28.1 ±1.6	17.3 ±0.5	65.2 ±2.1	35.0 ±1.5	109.9 ±2.3	112.5 ±2.5	3.05 ±0.13	5.33 ±0.43	223.2 ±17.1
	3	7	115.8 ±3.7	113.6 ±2.8	145.6 ±5.0	155.3 ±6.6	42.4 ±2.0	30.4 ±1.9	17.7 ±0.7	68.1 ±2.6	33.0 ±1.9	107.0 ±2.8	111.0 ±3.0	3.08 ±0.16	5.00 ±0.51	231.5 ±20.4
	4	16	118.1 ±2.3	115.1 ±1.7	145.3 ±3.1	150.7 ±4.1	40.9 ±1.3	29.1 ±1.2	17.7 ±0.4	67.4 ±1.6	32.8 ±1.1	109.3 ±1.7	112.8 ±1.9	3.10 ±0.10	4.93 ±0.32	232.7 ±12.7
Herd size	1	24	115.7 ±2.4	114.6 ±1.8	144.9 ±3.2	151.3 ±4.2	40.7 ±1.3	29.1 ±1.2	17.3 ±0.4	67.9 ±1.7	33.7 ±1.2	108.6 ±1.8	112.6 ±1.9	3.05 ±0.10	5.08 ±0.33	226.7 ±13.1
	2	15	121.3 ±2.7	113.5 ±1.9	142.0 ±3.6	148.5 ±4.7	40.5 ±1.4	31.1 ±1.4	17.9 ±0.5	67.2 ±1.8	33.5 ±1.3	108.4 ±2.0	111.5 ±2.1	3.13 ±0.11	4.86 ±0.36	229.1 ±14.4
	3	8	119.2 ±3.9	115.4 ±2.9	142.5 ±5.2	152.9 ±6.8	41.7 ±2.1	29.0 ±2.0	16.9 ±0.7	66.7 ±2.7	33.4 ±1.9	110.4 ±2.9	113.5 ±3.1	3.05 ±0.17	5.50 ±0.53	225.3 ±21.1
Land holding	1	13	120.5 ±3.1	117.1 ±2.3^a	147.0 ±4.1	153.0 ±5.4	42.4 ±1.7	32.0 ±1.6	18.3 ±0.5	72.0 ±2.1^a	37.7 ±1.5^a	110.8 ±2.3	113.8 ±2.5	3.21 ±0.13	4.72 ±0.42	242.9 ±16.7
	2	19	118.6 ±2.4	111.9 ±1.8^b	140.7 ±3.2	147.6 ±4.2	40.1 ±1.3	30.0 ±1.2	17.5 ±0.4	65.3 ±1.7^ab	31.7 ±1.2^b	106.9 ±1.8	110.3 ±1.9	3.04 ±0.10	4.60 ±0.33	221.3 ±13.1
	3	8	122.6 ±3.7	118.1 ±2.7^a	145.4 ±5.0	153.8 ±6.5	40.8 ±2.0	29.2 ±1.9	16.6 ±0.7	68.8 ±2.5^ab	33.2 ±1.8^b	112.8 ±2.8	116.9 ±3.0	3.17 ±0.16	5.87 ±0.51	240.4 ±20.3
	4	7	113.4 ±3.7	110.9 ±2.8^b	139.3 ±5.0	149.3 ±6.5	40.5 ±2.0	27.7 ±1.9	17.1 ±0.7	63.0 ±2.6^b	31.6 ±1.8^b	106.0 ±2.8	109.3 ±3.0	2.89 ±0.16	5.39 ±0.51	203.5 ±20.3
Regression			0.01 ±0.01	0.00 ±0.01	0.03 ±0.02	0.02 ±0.02	0.01 ±0.01	0.01 ±0.01	0.00 ±0.00	0.01 ±0.01	0.01 ±0.01	0.00 ±0.01	0.00 ±0.01	0.00 ±0.00	0.00 ±0.00	0.89 ±0.71
Overall		47	118.7 ±1.7	114.5 ±1.3	143.1 ±2.3	150.9 ±3.0	41.0 ±0.9	29.7 ±0.9	17.4 ±0.3	67.3 ±1.2	33.6 ±0.8	109.1 ±1.2	112.6 ±1.4	3.08 ±0.07	5.15 ±0.23	227.0 ±9.3

Least-squares means followed by same or no upper case letters as superscripts do not differ significantly (a, b; $P<0.05$).

Table 3. Least-squares means for morphometric traits in pregnant Frieswal heifers

Effects	Code	Obs.	BL	HAW	CG	PG	FL	FW	EPL	HE	HK	HPB	HHB	BSA	SKIN	EBW
Education	1	16	135.3 ±3.1	123.2 ±2.0	164.1 ±4.0	173.7 ±5.1	43.9 ±1.5	32.6 ±1.6	19.0 ±0.7	72.0 ±1.9	38.0 ±2.0	117.0 ±2.0	121.2 ±1.9	3.86 ±0.12	5.46 ±0.40	340.3 ±18.1
	2	18	134.7 ±2.7	121.8 ±1.7	161.1 ±3.4	169.6 ±4.3	44.0 ±1.3	31.6 ±1.3	19.6 ±0.5	69.5 ±1.6	38.4 ±1.7	115.5 ±1.7	119.8 ±1.5	3.83 ±0.10	5.84 ±0.35	326.8 ±15.5
	3	13	133.2 ±3.3	120.0 ±2.1	164.4 ±4.2	179.2 ±5.3	44.6 ±1.6	30.0 ±1.6	18.9 ±0.7	70.1 ±2.0	37.0 ±2.1	112.7 ±2.1	118.5 ±1.9	3.80 ±0.12	5.0 ±0.42	333.7 ±18.9
	4	15	133.1 ±2.8	120.0 ±1.7	161.5 ±3.5	171.4 ±4.4	42.5 ±1.3	32.4 ±1.4	19.0 ±0.6	69.5 ±1.7	35.8 ±1.8	114.9 ±1.8	118.8 ±1.5	3.82 ±0.10	5.66 ±0.36	325.9 ±15.9
Herd size	1	33	129.1 ±2.5	119.7 ±1.6	157.5 ±3.2	168.7 ±4.0	43.0 ±1.2	30.3 ±1.2	18.5 ±0.5	69.2 ±1.5	36.0 ±1.6	114.2 ±1.6	117.8 ±1.5	3.68 ±0.09	5.40 ±0.32	302.5 ±14.4
	2	19	133.6 ±2.5	120.2 ±1.7	162.5 ±3.2	172.3 ±4.0	44.0 ±1.2	33.2 ±1.2	18.3 ±0.5	71.6 ±1.5	36.4 ±1.6	114.8 ±1.6	117.2 ±1.5	3.83 ±0.09	5.61 ±0.32	329.8 ±14.4
	3	6	130.9 ±4.4	122.8 ±2.2	159.5 ±5.6	168.7 ±7.0	39.9 ±2.1	29.2 ±2.2	20.3 ±0.9	70.1 ±2.6	38.7 ±2.8	114.5 ±2.8	121.7 ±2.5	3.67 ±0.16	5.58 ±0.56	308.2 ±25.2
	4	4	142.7 ±5.3	122.3 ±2.4	171.6 ±6.7	184.2 ±8.4	48.1 ±2.5	33.8 ±2.6	19.3 ±1.1	70.1 ±3.1	38.1 ±3.3	116.5 ±3.4	121.6 ±3.1	4.13 ±0.20	5.86 ±0.68	386.2 ±30.2
Breeding	1	20	126.8 ±3.3	119.7 ±2.1	163.0 ±4.2	171.8 ±5.3	44.6 ±1.6	34.4 ±1.7	19.3 ±0.7	73.9 ±2.0	40.3 ±2.1	112.8 ±2.1	117.0 ±2.0	3.85 ±0.12	5.67 ±0.43	314.9 ±19.1
	2	25	135.6 ±2.7	120.2 ±1.7	162.9 ±3.5	173.3 ±4.3	43.8 ±1.3	31.1 ±1.3	18.9 ±0.6	68.5 ±1.6	36.4 ±1.7	114.2 ±1.7	119.6 ±1.5	3.81 ±0.10	5.49 ±0.35	334.4 ±15.6
	3	9	136.5 ±3.5	122.8 ±2.2	163.3 ±4.4	173.7 ±5.5	43.4 ±1.7	31.0 ±1.7	19.7 ±0.7	68.4 ±2.1	37.4 ±2.2	118.4 ±2.2	121.7 ±2.0	3.89 ±0.13	5.33 ±0.45	341.3 ±19.9
	4	8	137.5 ±3.9	122.3 ±2.4	161.9 ±4.9	175.1 ±6.2	43.3 ±1.9	30.0 ±1.9	18.5 ±0.8	70.2 ±2.3	35.1 ±2.5	114.7 ±2.5	120.0 ±2.3	3.77 ±0.14	5.97 ±0.50	335.9 ±22.3
Stage of gestation	1	34	129.5 ±2.2	121.1 ±1.4	157.8 ±2.8	167.1 ±3.5	44.0 ±1.1	31.3 ±1.1	19.4 ±0.4	70.7 ±1.3	36.3 ±1.4	113.0 ±1.4	118.0 ±1.3	3.55[A] ±0.08	5.00[a] ±0.28	299.7[a] ±12.7
	2	19	135.0 ±2.7	121.2 ±1.7	165.1 ±3.5	173.0 ±4.4	42.8 ±1.3	31.1 ±1.3	18.9 ±0.6	69.5 ±1.6	36.6 ±1.7	115.4 ±1.8	120.2 ±1.5	3.87[A] ±0.10	5.85[b] ±0.35	341.1[b] ±15.7
	3	9	137.6 ±3.6	121.5 ±2.2	165.3 ±4.5	180.3 ±5.7	44.5 ±1.7	32.6 ±1.8	19.0 ±0.7	70.6 ±2.1	39.0 ±2.3	116.7 ±2.3	120.5 ±2.1	4.07[B] ±0.13	6.00[b] ±0.46	354.2[b] ±20.5
Regression			-0.01 ±0.01	-0.00 ±0.01	-0.03 ±0.02	-0.03 ±0.02	-0.00 ±0.01	0.00 ±0.01	-0.00 ±0.00	-0.01 ±0.01	-0.01 ±0.01	-0.00 ±0.01	-0.00 ±0.01	0.00 ±0.00	0.00 ±0.00	-0.12 ±0.01
Overall		62	134.1 ±1.9	121.3 ±1.2	162.7 ±2.4	173.5 ±3.0	43.8 ±0.9	31.7 ±0.9	19.1 ±0.4	70.3 ±1.1	37.3 ±1.2	115.0 ±1.2	119.6 ±1.1	3.83 ±0.07	5.62 ±0.24	331.7 ±10.9

Least-squares means followed by same or no upper case letters as superscripts do not differ significantly (a, b; $P<0.05$), (A, B; $P<0.01$).

Herd size

Out of the 127 respondents, 51.18% had herd size of 3 AUE, 33.86% had 3 to 6 AUE, 10.24% had 6 to 10 AUE and 4.72% had herd size more than 10 AUE. This indicates that most of the farmers owned small herd size and a very few had large size herds. Present finding is in close agreement with those reported by Arora (2002). Saran *et al.* (2000) observed in Bundelkhand region of Uttar Pradesh that large farmers (>10 acres) kept more livestock compared to small farmers (<5 acres). Pundir *et al.* (2014) also observed that herd size ranged from 2 to 5 animals in Garhwal region of Uttarakhand.

Land holding

Majority (44.09%) of respondents possessed up to 5 acres of land. Per cent of respondents holding 5 to 10 acres of land was 14.17 and those possessing more than 10 acres was 18.11%. Landless farmers were 23.62%. Study indicated that livestock rearing is a source of livelihood to those farmers also who do not have land. Present finding is in close agreement with those reported by Bardhan *et al.* (2005) in Udham Singh Nagar in Uttarakhand. Gangil and Dabas (2005) reported that relationship between land holding and level of knowledge of livestock farmers in animal husbandry practices was significant and positive. It signified large land holding farmers possess more knowledge as compared to small and marginal land holding farmers because large farmers have better resources and more exposure to mass media and they have more opportunities to acquire more knowledge.

The overall least-squares means of 47 heifers around puberty (± 30 days) were 118.7 ± 1.7 cm for BL, 114.5 ± 1.3 cm for HAW, 143.1 ± 2.3 cm for CG, 150.9 ± 3.0 cm for PG, 41.0 ± 0.9 cm for FL, 29.7 ± 0.9 cm for FW, 17.4 ± 0.3 cm for EPL, 67.3 ± 1.2 cm for HE, 33.6 ± 0.8 cm for HK, 109.1 ± 1.2 cm for HPB, 112.6 ± 1.4 cm for HHB, 3.08 ± 0.07 m^2 for BSA, 5.15 ± 0.23 mm for SFT and 227.0 ± 9.3 kg for EBW. These values are in close agreement to those reported by (Kumar, 1990) in crossbred cattle, (Gaur *et al.* 2006) in Frieswal and (Singh *et al.* 2011) in Vrindavani cattle under farm conditions. Koirala *et al.* 2011 observed the mean BL of Sylhet cattle to be 119.85 ± 16.96 cm which is in close proximity to our finding. Least-squares means for various morphological traits for pubertal Frieswal heifers are presented in Table 2.

The analysis of variance revealed significant (P<0.05) effect of land holding on HAW, HE and highly significant (P<0.01) effect of land holding on HK. The values were generally higher in landless and medium land holders.

Education level and herd size, however, did not statistically influence any of the traits under study. Effect of regression on puberty was positive and significant (P<0.05) on FW.

The overall least-squares means of 62 pregnant heifers were 134.1 ± 1.9 cm for BL, 121.3 ± 1.2 cm for HAW, 162.7 ± 2.4 cm for CG, 173.5 ± 3.0 cm for PG, 43.8 ± 0.9 cm for FL, 31.7 ± 0.9 cm for FW, 19.1 ± 0.4 cm for EPL, 70.3 ± 1.1 cm for HE, 37.3 ± 1.2 cm for HK, 115.0 ± 1.2 cm for HPB, 119.6 ± 1.1 cm for HHB, 3.83 ± 0.07 m^2 for BSA, 5.62 ± 0.24 mm for SFT and 331.7 ± 10.9 kg for EBW. These values are in close agreement to those reported by (Gaur *et al.* 2006) in Frieswal, (Parveen *et al.* 2009) in Sahiwal and (Singh *et al.* 2011) in Vrindavani cattle under farm conditions. Present value is found higher than those reported by Dash *et al.* 2013 in Binjharpuri cattle. Khirari *et al.* (2014) also observed that the ear pinna length of non-descript cattle was 18.06 ± 0.21 cm which is in close proximity to our findings. Least-squares means for various morphological traits for pregnant Frieswal heifers are presented in Table 3. The analysis of variance revealed highly significant (P<0.01) effect of stage of gestation on BSA and significant (P<0.05) effect of stage of gestation on SFT and EBW. These values were generally higher for 3rd stage of gestation (181-270 days) than first stage of pregnancy (up to 60 days), as expected. The effects like land holding and stage of gestation did not significantly influence the traits like BL and HE. The effect of regression on age was non-significant to the traits under study.

CONCLUSION

Present findings indicated that rearing of Frieswal cattle is mostly done by educated people. Most of the farmers owned small herd size and a very few had large size herds and also present study indicated that livestock rearing is a source of livelihood to those farmers also who do not have land. Analysis of variance revealed significant (P<0.05) effect of land holding on HAW, HE and highly significant (P<0.01) effect of land holding on HK. Effect of regression on age at puberty was positive and significant (P<0.05) on FW. Analysis of variance revealed highly significant (P<0.0.1) effect of stage of gestation on BSA and significant (P<0.05) effect of stage of gestation on SFT and EBW.

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