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Body Conformation in Tharparkar Cattle as a Tool of Selection

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ABSTRACT

For present investigation, Tharparkar cows available at Cattle and Buffalo Farm, Indian Veterinary Research Institute, Izatnagar (U.P.) were used. Body conformation scoring was done as per modified International Committee on Animal Recording (2012). Measurements were taken in centimeter (cm) before morning milking and prior to any feed intake using graduated measuring stick, vernier caliper and flexible meter tape. In Tharparkar cattle, the average score points (ASP, under 1-9 point scale score system) for body conformation traits like stature (5.02: intermediate), chest width (4.71: intermediate), body depth (4.75: intermediate), angularity (5.60: intermediate), rump angle (5.55: intermediate), rump width (4.80: intermediate), rear leg rear view (7.39: parallel), rear leg set (5.27: intermediate), foot angle (7.09: steep), fore udder attachment (6.44: strong), fore teat placement (3.80: intermediate), teat length (4.71: intermediate), udder depth (5.71: intermediate), rear udder height (3.46: intermediate), central ligament (5.27: intermediate), rear teat placement (5.82: intermediate), locomotion (7.20: no abduction), hock development (7.28: dry), bone structure (6.64: fine and thin), rear udder width (5.64: intermediate), teat thickness (2.61: narrow), muscularity (6.00: intermediate), hump size (3.98: intermediate), dewlap size (5.04: intermediate) and naval flap size (3.09: intermediate) were assessed. Most of the body conformation traits in Tharparkar cows were of intermediate nature and of desirable type, moreover, some traits also showed the presence of undesirable ASP, which expressed scope for further improvement. Thus, present investigation gave explicit clue to bring Tharparkar cattle at par with other exotic breeds, if little effort is made to incorporate these conformation traits in selection program.

Keywords: Tharparkar cattle, Body Conformation, Selection, Type traits

Tharparkar is a dual-purpose breed valued for its milk as well as draught utility. The breed is adapted to the inhospitable Thar desert conditions of Rajasthan and parts of Gujarat extending up to Rann of Kutch, typified by summer temperature hovering above 50°C, scarce rainfall and vegetation and scarcity of even drinking water. Over the years, elite animals of this breed have been frequently used for upgrading local low-yielding cattle breeds in addition to crossbreeding within and outside the country. There are certain body parts of a cow, commonly known as type traits, which makes her capable to produce milk. These traits, which are directly or indirectly linked with each other, are called linear type traits. Up till now, breeds of cattle have been classified on the basis of their colour pattern or typical body characteristics but in the modern system of classification as recommended by the International committee of animal recording (2012), the animals are classified on the basis of their body conformational characteristics. The linear type traits of the animal are the basis of modern day classification system and are used to describe the dairyness of a cow on the basis of their body conformation. In linearized type scoring system, individual linear type traits were scored on 1-9 point scale in which biological extremes of the traits are-considered, i.e. minimum to maximum degree rather than desirability is considered. Linear measurements could

be taken at relatively lower cost, with relative accuracy and consistency (Essien and Adesope, 2003; De Haas *et al.*, 2007). Linear evaluation is based on measurement of individual traits instead of opinions. It describes the degree of traits and not desirability, hence through the use of linear system, unbiased data for conformation is provided to dairy producers. Van Dorp et al. (1998) showed that cows with longer teats were genetically predisposed to a higher incidence of mastitis. Higher pin bones as compare to hook bones are associated with an undesirable tilt to the vaginal canal causing it to lie at an inward sloping angle rather than lying tilt. With this type of angle, the reproductive tract is more prone to infection because the vagina is unable to drain effectively (Astis *et al.*, 2002). During parturition, the natural exit path for a calf is at a downward angle. The cows with high and narrow pin bones had an increased genetic predisposition to retained placentas (Van Dorp *et al.*, 1998). Animals with intermediate rump angles had a longer productive life (lower rate of culling) than animals with extremely low or extremely high pin bones in relation to hip bones (Pérez Cabal and Alenda, 2002). The deformity in foot angle leads to increase in the incidences of ovarian cysts, effects conception rate at fist service and overall pregnancy rate (Melendez *et al.*, 2002). Since conformation traits are heritable and have been shown to be linked with functionality and involuntary culling, selection for conformational traits is an effective tool to facilitate genetic improvement in functionality. This is the reason that type traits have been used as indirect selection criteria for improving the herd life of dairy cow (Cruickshank *et al.*, 2002). The different traits have their own contribution on production performance of animal; moreover, improvement in these type traits can improve the herd life of dairy cows besides improving their milk production level. So, the present investigation was designed to determine various traits which need to be improved for improving the productive life span and longevity of this valuable germplasm commonly found in arid part of western India and Pakistan.

MATERIAL AND METHODS

Experimental site

The study was conducted on the Tharparkar cows available at Cattle and Buffalo Farm, Indian Veterinary Research Institute, Izatnagar (U.P.), located between 28.22°N latitude, 79.22°E longitude and at an altitude of 568 feet above mean sea level. The climatic conditions of the place touch both the extremes viz. cold (approximately 5°C in winter) and hot (approximately 45°C in summer). The relative humidity ranges between 15 and 85%. The average annual rainfall is about 90 to 120 cm and most of which is received during the months of July to September.

Animals and managements

All the Tharparkar animals were stall fed under loose house as per the age groups and different physiological stages. The feeding of animals was done as per the recommendations of nutritional experts. The nutritional requirements are met through a balanced combination of green and dry fodder along with concentrate mixture supplementation. Animals were vaccinated against FMD, Brucellosis and HS as per the recommended schedule.

Data collection

Data from 61 cows were used for this study. All the animals were more than 6 years of age (attained full body growth) having 2nd & 3rd lactation. At the time of score animals were non pregnant and in lactating stage. Average milk yield of these animals in previous lactation was 1554.75 kg. Data were collected between 2013 and 2014. Body conformation scoring was done as per modified International Committee on Animal Recording (2012). Out of 23 linear type traits 18 traits are approved standard traits while last five traits are common standard traits of International Committee for Animal Recording. These are Stature, Chest Width, Body Depth, Angularity, Rump Angle, Rump Width, Rear Legs Set, Rear Legs Rear View, Foot Angle, Fore Udder Attachment, Rear Udder Height, Central Ligament, Udder Depth, Front Teat Position, Teat Length, Rear Teat Position, Locomotion, Body Condition Score, Hock Development, Bone Structure, Rear Udder Width, Teat Thickness and Muscularity. For indigenous breed (Tharparkar) the conformation traits like hump size, dewlap size and size of the naval flap are also included in the study. Measurements were taken in centimeter (cm) before milking and prior to any feed intake using graduated measuring stick, vernier caliper and flexible meter tape.

Statistical analysis

The data collected were subjected to means and standard error through Duncun test by using SPSS Version 17.

RESULTS AND DISCUSSION

Body conformation scoring was done as per modified guideline of International Committee on Animal Recording (2012) and then range of score points was divided into three groups (Table 1).

Stature (ST)

It is measured from the top of the spine in between hips to the ground. Taller or higher stature is a desirable trait as this type of animal usually carries their udder higher and prevent occurrence of mastitis. Larger stature also reflects bigger body size, tends to eat more feed and directs more nutrients to produce higher milk. In Tharparkar cows, the average score points (ASP) for this trait was found to be 5.02 (Table 1), which is intermediate hence, this trait possess further scope for improvement in Tharparkar cows.

Chest Width (CW)

It also indicates body capacity of an animal and measured from the inside surface between the top of the front legs. A cow with a very wide front part i.e. with front legs far apart, with a broad shoulder and a big rib cage indicates larger body capacity and higher productive ability. The animals with narrow chest width have greater chances of being culled. In Tharparkar cows, the observed ASP for this trait was 4.71, which indicated presence of desirable intermediate chest width (Table 1). Similar finding were reported in Sahiwal cows by Dubey et *al.* (2012).

Body Depth (BD)

Body capacity is controlled by length, depth and spring or degree of arch of ribs. Body depth also defines body capacity and classified as the distance between the top of the spine and bottom of the body at the start of the last rib i.e. at the deepest point of the body. Bigger body capacity is indicative of larger digestive system which is further associated with increased capacity to consume large amounts of concentrate and forages and hence produce more milk. In Tharparkar cows, the observed ASP for BD was 4.75, which indicated the presence of intermediate body depth (Table 1). It was in accordance with Thompson *et al.* (1981) in Holstein cattle and Dubey *et al.* (2012) in Sahiwal cattle. Deep body depth is a trait, which denotes the food digestion and assimilation capacity of animal, considered to be most desirable among all groups (Dubey, 2010). Hence, this trait possesses scope for further improvement in Tharparkar cows.

Angularity (ANG)

Researchers have reported a high positive correlation (0.45 to 0.60) between dairy character and milk yield (Trimberger and Etgen, 1983). Ribs should be wide apart and slanted toward the rear and referred to as openness. Rib bones should have adequate depth. The observed ASP for this trait was 5.60 indicating intermediate angularity in Tharparkar cows (Table 1).

Rump Angle (RA)

Rump angle is defined as the angle of the rump structure from hips to pins, from side of the cow. Proper rump conformation is important because it provides proper support to udder. A rump with the pin bone slightly lower than the hips, along with wider pins is preferred because it helps in lesser calving difficulty, fewer reproductive problems, better uterine drainage, improved genital tract health and greater longevity. Pins higher than hooks is often, but not always, caused by the thurl placement being too far back. Thurl located too far back are often associated with faulty leg structure. Cows with extreme slope to the rump sometimes also have undesirable set to the hock or are awkward in their hind leg movement. The relative risk of involuntary culling due to reproductive ailments was lowest at intermediate rump angle (Thompson *et al.*, 1981). The observed ASP for this trait was 5.55 indicating intermediate rump angle (Table 1), which was also observed in HF cow by Berry (2007) and in Sahiwal cows by Dubey (2010).

Rump width (RW)

It indicates the distance between rear most point of pin bones. The rump width on either side of extreme is associated with reproductive ailments (Dubey *et al.*, 2012), however, in Tharparkar cattle, the desirable intermediate rump width was observed with ASP of 4.80 (Table 1). Moreover, similar results were observed in HF cows by Wall *et al.* (2005) and in Sahiwal cows by Dubey (2010).

Rear leg rear view (RLRV)

Rear view is assessed as direction of the rear feet when viewed from back. Cows that hock-in and toe out have increased stress on their feet and legs and may have increased trauma to the rear udder as they walk. The hind legs of a dairy cow should be set well apart and nearly straight when viewed from the rear. The observed ASP was 7.39 (Table 1) indicating desirable parallel rear view of rear legs, however, in Sahiwal cattle it was intermediate (5.95, Dubey, 2010). It shows that as compare to Sahiwal cattle there is a less stress on their feet in Thararkar cattle so, less chances of lameness and less trauma to the rear udder.

Rear leg set (RLS)

The rear leg set is always classified from the side view. The optimal angle at the hocks measures between 150 to 155 degrees. A bigger angle means straight rear posty legs and a lower angle means sickled rear legs. Cows having more than the desired set to the hock put too much stress on leg muscles and tendons. The most desirable set is somewhere between the posty and sickled legs, posty-legged cows lack flex to the hind legs which may cause swelling in the hock or stifle and may cause them to be uncomfortable on their legs. If a straight legged cow moves with ease and flex to the hock with no evidence of swelling in the joints, her legs probably are not too straight. The intermediate set of hock angle could be related with increased herd life (Atkins and Shannon, 2002). In Tharparkar cattle, desired intermediate hock angle with ASP of 5.27 was observed (Table 1), which was in accordance with Norman et al. (1988) in Ayrshire cattle and Dubey et al. (2012) in Sahiwal cattle.

Foot Angle (FA)

The foot angle describes the angle between a flat surface and the front slope of the claw. Cows that have a steep foot angle require less hoof trimming have better mobility and greater longevity. A 45° angle is the minimum angle desired. A foot angle with more steep might interfere with the proper cushioning effect of the pastern and could put undue stress on the joints. The steep foot angle is the most desirable, because it enables the cow to cope better with uneven and stony ground (Dubey *et al.*, 2012). Moreover, it also reduces the involuntary culling associated with milk production (Rogers *et al.*, 1989). In Tharparkar cows, desired steep foot angle with ASP 7.09 was observed (Table 1), which was contradictory to that of Sahiwal cows (5.66, Dubey *et al.*, 2012).

Fore Udder Attachment (FUA)

The fore udder is very important in the overall udder conformation. Fore udder attachment is an evaluation of the strength of the fore udder attachment to the body wall by the lateral ligaments, it is the third most important physical trait of the udder when predicting herd life. Its floor should continue at the same level as that of the rear udder. The ideal fore udder is moderately long and has a gentle and gradual curve upward before it blends smoothly with the body. Additionally, moderate amount of bulge to the fore udder is expected in high producing dairy cows. The strong fore udder attachment is the most desirable. In Tharparkar cows, the desired fore udder attachment with ASP of 6.44 was observed (Table 1). Similar findings of this trait were also reported by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 84.5, 74.2 and 75.1 points, respectively.

Fore teat placement (FTP)

This trait measures the placement of front teat on quarter of udder. Both fore and rear teat placements at either extreme of measurement in cows increases the chances of being culled (Berry, 2007). However, in Tharparkar cows, the desirable intermediate placement was observed with ASP of 3.80 (Table 1). Similar intermediate findings of this trait were also reported by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 74.8, 74.2 and 74.5 points, respectively.

Teat Length (TL)

It indicates the length of front teats and is measured as a distance from base to the tip of the front. The teat with intermediate length is most desirable (Dubey *et al.*, 2012). In Tharparkar cattle, ASP of 4.71 was observed (Table 1) indicating presence of intermediate teat length.

Udder Depth (UD)

Udder depth is the most important physical trait of the udder. It is evaluated as the relationship of the udder floor relative to the hocks. Higher udders are related with less mastitis, less udder injury and greater longevity. Udders below the hock are a serious fault. In Tharparkar cows, the observed ASP was 5.71(Table 1) indicating intermediate depth of udder, which shows scope of further improvement. However, similar reports were observed in Spanish Holstein by Perez-Cabal (2002) and in Sahiwal cattle by Dubey *et al.* (2012). Similar intermediate findings of this trait were also reported by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 87.9, 81.7 and 79.4 points, respectively.

Rear Udder Height (RUH)

The distance between the bottom of the vulva and top of the milk secreting tissue determines rear udder height. A high rear udder attachment is thought to be an indicator of more udder and milk production capacity. The high rear udder is considered better than other groups. In Tharparkar cattle, ASP of 3.46 was observed (Table 1) which indicated scope of further improvement. Similar intermediate reports for this trait were also reported by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 69.0, 64.8 and 74.5 points, respectively.

Central ligament (CL)

The depth of cleft is measured at the base of the rear udder, between rear teats. A deep udder cleft is an indicator of a strong median suspensory ligament. This is an elastic ligament, in the centre of the udder that provides 60% of support. Strong suspensory ligament causes uniform placement of teats at udder floor, whereas loose ligament make wide space between teats which often creates problem during machine milking. In Tharparkar cattle ASP of 5.27 was observed (Table 1) with intermediate central ligament. Similar intermediate reports of this trait were also found by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 76.1, 76.0 and 77.1 points, respectively.

Rear teat placement (RTP)

This trait measures the placement of rear teats on the quarter of udder. The ASP for this trait was 5.82 which indicated desirable intermediate placement of rear teat in Tharparkar cattle (Table 1). Similar to the present intermediate finding, Dubey *et al.* (2012) in Sahiwal cows reported an ASP of 6.37.

Table 1. Score point range and average score point (ASP) of different conformation traits in Tharparkar cows

Traits	Score point range			ASP ± SE	Interpretation	Desirable
	1-3	4-6	7-9			
ST	Short	Intermediate	Tall	5.02 ± 0.64	Intermediate	Tall
CW	Narrow	Intermediate	Wide	4.71 ± 0.59	Intermediate	Intermediate
BD	Shallow	Intermediate	Deep	4.75 ± 0.61	Intermediate	Deep
ANG	Coarse	Intermediate	Angular	5.60 ± 0.72	Intermediate	Angular
RA	High pins	Intermediate	Low pins	5.55 ± 0.70	Intermediate	Intermediate
RW	Narrow pins	Intermediate	Wide pins	4.80 ± 0.60	Intermediate	Intermediate
RLRV	Toe out	Intermediate	Parallel	7.39 ± 0.95	Parallel	Parallel
RLS	Straight	Intermediate	Sickled	5.27 ± 0.68	Intermediate	Intermediate
FA	Low	Intermediate	Steep	7.09 ± 0.90	Steep	Steep
FUA	Loose	Intermediate	Strong	6.44 ± 0.83	Strong	Strong
FTP	Wide	Intermediate	Close	3.80 ± 0.48	Intermediate	Intermediate

TL	Short	Intermediate	Long	4.71 ± 0.59	Intermediate	Intermediate
UD	Below hock	Intermediate	Shallow	5.71 ± 0.73	Intermediate	Shallow
RUH	Low	Intermediate	High	3.46 ± 0.45	Intermediate	High
CL	Weak	Intermediate	Strong	5.27 ± 0.68	Intermediate	Strong
RTP	Wide	Intermediate	Close	5.82 ± 0.75	Intermediate	Intermediate
LM	Short stride/ Abduction	Intermediate	long stride/No abduction	7.20 ± 0.93	long stride/ No abduction	long stride/ No abduction
HD	Filled	Intermediate	Dry	7.28 ± 0.93	Dry	Dry
BS	Coarse	Intermediate	Fine & Thin	6.64 ± 0.85	Fine & Thin	Fine & Thin
RUW	Narrow	Intermediate	Wide	5.64 ± 0.70	Intermediate	Wide
TT	Narrow	Intermediate	Thick	2.61 ± 0.31	Narrow	Intermediate
MS	Poor	Intermediate	Grossly muscular	6.00 ± 0.77	Intermediate	Intermediate
HS	Small	Intermediate	Large	3.98 ± 0.53	Intermediate	Intermediate
DLS	Small	Intermediate	Large	5.04 ± 0.63	Intermediate	Intermediate
NFS	Small	Intermediate	Large	3.09 ± 0.40	Intermediate	Intermediate

Locomotion (LM)

It is the description of the use of feet and legs, including direction and length of the steps and free and smooth movement. Highest priority is given to the direction of the step and gets highest score when we observe parallel and long strides, free and smooth movement, footsteps of the rear legs is in or in front of the footsteps of the forelegs. Severe abduction or adduction and short strides are treated as poor locomotion. The ASP for this trait was 7.20 in Tharparkar cows of the present study (Table 1).

Hock Development (HD)

The quality of the hocks is assessed from the back as well as from the side of the cow. The bone structure is not included as a part of the assessment of hock quality. The desirable type of hock is completely 'clean and dry' without any fluid and receives highest score and hock filled with lot of fluid receives lowest score. In Tharparkar cows, the observed ASP of this trait was 7.28 indicating clean and dry hock (Table 1).

Bone Structure (BS)

It is assessed by looking the cannon bone in rear view. Coarse bone (broad and thick) is undesirable and receives minimum score. The very fine and thin bones are desirable and receives very high score. The ASP for this trait in Tharparkar cows was of the present study was 6.64 (Table 1).

Rear Udder Width (RUW)

Rear udder width is evaluated at the point of attachment where the rear udder is attached to the 'mirror'. Like rear udder height, the rear udder width is also an indicator of udder capacity. When width of the udder attachment is 7 cm. or less, it gets least score. Similarly, width of 23 cm. or more is desirable and gets maximum score. In Tharparkar cows, the desired rear udder width with ASP of 5.64 was observed (Table 1). Similar reports for this trait were also found by Vinayak (1989); Vij *et al.* (1990); Dahiya and Rathi (2002) in Tharparkar cattle on 50-99 scale which were 81.5, 73.8 and 75.9 points, respectively. Still there is chances of improvement in this trait.

Teat Thickness (TT)

It is assessed in the middle of front teats. The teats with intermediate thickness is believed to be intermediate type, however in Tharparkar cattle, thin teat with ASP of 2.61 was observed (Table 1) which indicated scope for further improvement. Dubey *et al.* (2012) in Sahiwal cows reported an ASP of teat thickness is 2.76.

Muscularity (MS)

It is the amount of muscles as seen in the loin and thighs. Well developed, fat free and lean musculature is indicative of higher production capability. In Tharparkar cows, the desired muscularity with ASP of 6.00 was observed (Table 1).

Hump size (HS)

It is height of hump from mid of the base of hump. In Tharparkar females, intermediate type of hump with ASP 3.98 was observed (Table 1).

Dewlap size (DS)

It is the highest width which is hanging to the neck. Size of dewlap in Tharparkar cattle was intermediate with ASP 5.04 (Table 1).

Naval flap size (NFS)

It is the highest length of naval which is hanging in front of naval cord. It was found to be intermediate type in Tharparkar cows with ASP of 3.09 (Table 1).

CONCLUSIONS

Most of the body conformation traits in Tharparkar cows were of intermediate nature and of desirable type, except some like stature, body depth, angularity, central ligament, rear udder height, udder depth, rear udder width and teat thickness which expressed scope for further improvement. Moreover, traits in which the desired group is intermediate (ASP of 4-6), the ASP, which lies near midpoint i.e., ASP near five, is considered to be the most desirable. Thus, present investigation gave overt clue to bring Tharparkar cattle at par with other exotic breeds, if little effort is made to integrate these conformation traits in selection programme.

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