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# Comparative Effects of Dam Milk and Milk Replacer on the Conformation Traits and Growth Outcomes of Holstein Friesian Calves

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## Article Details

**Keywords:** Friesian Calves, Milk Replacer, Dam Milk, Body Growth, Conformation Traits

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## ABSTRACT

Holstein Friesian calves (n=12) were contained at Government breeding and Dairy Farm Nushki, Balochistan for an experimental period of ninety days to compare the calf growth and conformation kept on different feeding systems i.e. Milk replacer vs. mother (Dam) milk. Six calves were given milk replacer and rest of the six was fed dam milk. However, the calves given milk replacer had a greater increase in body length (24.94cm) and weight (21.18kg) than the calves under dam milk during the experimental length. Likewise, calves that were feeding with milk replacer developed to a total average height of 23.20 cm followed by calves fed under dam milk were recorded 15.67 cm. on the other hand; the body width of calves given milk replacer was recorded as 16.22 cm as compare to calves under dam fed i.e. recorded 10.95 cm. Overall it was determined that the milk replace outcomes found elevated followed by calves under dam fed. So therefore, elevated difference in body weight, length, height and width during the experimental length was recorded 5.80 kg, 8.09 cm, 7.53 cm and 5.27 cm respectively. The obtained data found a significant ($P<0.05$) influence of feeding practices on the growth and body conformation characteristics of Holstein Friesian calves. However, it is concluded that the use of a milk replacer was more supportive than the use of dam milk in terms of improving the commercial values, conformation and adaptation of the calves.

## INTRODUCTION

A well-balanced diet is essential for calves to perform at their best and to be healthy. Reducing calf mortality and raising dairy cows' lifetime output are dependent on the well-being, welfare, and performance of young calves [1, 2]. The milk replacer (MR) feeding regimen, which stimulates postnatal growth and development through intense food intake to improve the structural growth, organ development, health and wellbeing, has been the subject of several research [3]. Regular milk allowances of around 10% of the body weight (BW) of the calves were often supplied by feeding practices, mainly to boost the intake of solid feed and promote rumen development for an early weaning date. These limited feeding methods may have an impact on calf welfare and growth potential [4]. When a calf is left with its dam, it will often suckle seven to ten times a day and drink a lot more milk than when it is given a total of around 10% of its body weight. Calves given milk or milk replacer (MR) at a high rate during the pre-weaning phase will gain weight more quickly [5].

The global trend in raising dairy calves is to gain maximum calf growth using MR of high nutritional quality. The increased pre-weaning nutritional intake derived from MR is associated with improved future milk production [6]. The dairy industry has continually moved toward feeding more milk or MR to young calves for benefits in improved growth rates [7], health outcomes [8], welfare, and potential for improved milk production in the first and subsequent lactations [9]. The milk replacers need to have a protein level may be up to 28 percent and its fat content ought to be around 17 percent [10]. However, some studies have illustrated that dry feed intake is equally influential on increasing early growth rates and later performance in lactation in replacement heifers [9, 11].

The nutritional quality of commercial MR differs significantly from whole milk containing more bioactive components such as enzymes, hormones and growth factors [12], and the possibility of greater body weight at weaning may arise if there are indicators of long-term benefits on future milk production as a result of compositional differences [13]. Showcasing the positive, long-term outcomes of improving early-life growth and health has stimulated greater interest in calf research, with the amount of research dedicated to heifer nutritional management doubling over the past decade [14]. Despite growing interest, 10 to 15% of heifers born do not reach first calving [15], demonstrating that there is still significant

room to improve heifer management strategies. These strategies can be largely improved by optimizing nutritional management, which has the potential to benefit the dairy industry via improved production, efficiency, health, and animal welfare.

Therefore, the study was focused on to compare the growth of Friesian calves in setting of two feeding systems i.e. milk replacer feeding and Dam feeding. This study was to determine the growth performance of dairy calves fed increasing amounts of a milk replacer formulated to be adequate in CP content and then harvested at the same age.

## MATERIALS AND METHODS

The entire experimental procedures and designated place of the present study was approved by the Animal Care & Use Committee of Livestock & Dairy Development Department, Government of Balochistan, Pakistan.

A Holstein Friesian calves (n=12) were reared at the Government Breeding & Dairy Farm Nushki, Balochistan, for an experimental period of 90 days. After artificial insemination (AI), Parturition of all calves was occurred in the same dairy farm on different time intervals. Of the twelve calves, six were given milk replacer while rest was kept on Dam feeding. Calves were contained in a curtain sided, naturally ventilated barn in 1.2 × 2.4m pens bedded with straw.

The present trial was conducted on January 2024 under the contented pens and environment. Temperature of barn was remained between 21°C to 27°C throughout the study period.

## EXPERIMENTAL GROUPS

The initial age of calves in control (**Group-A**) and the test group (**Group-B**) were 1 to 15 days, and all the growth performance parameters including body weight, length, height and width were assessed on day before experiment and then on weekly basis till 90 days. Test group of calves were fed with milk replacer 1 kg/ 7 liter (Eurolac Green 22/18, Neitherland, available in Pakistan through Solve Agri Pak) added with various standard chemical and others supplements as the detail given on company brochure.

## FEED INTAKE MANAGEMENT

In the present study the solid/ powered form of milk replacer was diluted in liquid as per manufacturer instructions. The Holstein Friesian calves were provided recommended

management and conditions i.e. water was permissible *ad libitum*, and feeding was allowed three times a day like early in the morning, after noon at 14hrs and then 20hrs. The feeding pattern was set same for both of the groups A and B.

As group-A was on natural Dam feeding while Group-B was fed milk replacer by plastic feeders with nipples. During the first week of trial, average three liters of liquid milk replacer was fed to the calves of group-B. Quantity of feed was increased with the progression of age.

For the growth performance, body weight of calves was observed by using plate form field balance available at the experimental unit where weekly weight gain was obtained on the basis initial body weight. Similarly, the length, height and width were recorded by using the measuring tape.

**STATISTICAL ANALYSIS OF DATA**

Analyses of variance (ANOVA) was created to see the significance difference between the treatment means; while DMR tests were employed in order to compare treatment means. Statistic (version 8.1) Analytical Computer Software Package was used to analyze the data.

**RESULTS**

Milk replacer was historically developed in order to spare salable milk. However, milk replacer is now valued for its ability to provide a convenient, safe, consistent, and cost-effective source of nutrients for pre-weaned calves. However, calves gained an excellent pre-weaning growth during the supplementation of milk replacer. In fact, pasteurized milk had a higher Average Daily Gain (ADG) than calves fed unpasteurized milk.

**BODY WEIGHT OF CALVES**

Weekly live bodyweight of Holstein Friesian calves managed on milk replacer and dam milk. According to the revealed results, during the last day of first week of experiment, the weight of Holstein Friesian calves given milk replacer was 37.51kg and calves weight under dam feeding was recorded 36.12kg, likewise, at the end of thirteen week of experiment, calves body weight under milk replacer feeding was recorded as 58.69kg whilst calves weight undergo dam feeding was 51.50kg, as described in table-1.

The results demonstrated significant difference in body weight due to feeding systems during thirteen weeks (±90 days). Statistically, the differences in the weight of Holstein Friesian calves under two feeding systems were significant ($P<0.05$); and the differences in

body weight was also significant (P<0.05) between weeks and interaction between feeding systems and weeks. It was also observed that the body weight of Holstein Friesian calves increased significantly (P<0.05) with the development of age and at the end of each week, there was a considerable increase in the body weight of calves in both the groups. However, the increase in bodyweight of calves under milk replacer was tremendous and greater than those managed under dam milk.

**TABLE 1: WEEKLY BODY WEIGHT (KG) OF HOLSTEIN FRIESIAN CALVES FED ON MILK REPLACER AS COMPARED TO MOTHER FEED**

| Weeks | Calves feeding system & Weight gain (kg) | | Difference |
|---|---|---|---|
| | Mother feed | Milk Replacer | |
| 1 | 36.12 | 37.51 | 1.39 |
| 2 | 37.21 | 38.94 | 1.73 |
| 3 | 38.32 | 40.42 | 1.90 |
| 4 | 39.47 | 41.95 | 2.48 |
| 5 | 40.65 | 43.55 | 2.90 |
| 6 | 41.87 | 45.20 | 3.33 |
| 7 | 43.13 | 46.92 | 3.79 |
| 8 | 44.42 | 48.70 | 4.28 |
| 9 | 45.76 | 50.55 | 4.79 |
| 10 | 47.13 | 52.47 | 5.34 |
| 11 | 48.54 | 54.47 | 5.93 |
| 12 | 50.00 | 56.54 | 6.54 |
| 13 | 51.50 | 58.69 | 7.19 |
| **Total weight gain (13 weeks)** | **15.38** | **21.18** | **5.80** |
| **Av. Weekly weight gain** | **1.183** | **1.629** | **0.446** |
| **Av. Daily weight gain** | **0.169** | **0.233** | **0.064** |

| | Calf Feeding systems (S) | Weeks (W) | S*W |
|---|---|---|---|
| S.E. | 0.1575 | 0.4015 | 0.5679 |
| LSD 0.05 | 0.3117 | 0.7947 | 1.1239 |
| LSD 0.01 | 0.4120 | 1.0503 | 1.4854 |
| F-Value | 639.92 | 435.56 | 10.97 |
| Probability | 0.0001 | 0.0001 | 0.0001 |
| Significance | ** | ** | ** |

On behalf of comparative analysis, total weight gained of calves during thirteen weeks was recorded 15.38kg and 21.18kg under the feeding of dam and milk replacer respectively. Similarly, average weight gain on weekly and daily basis was also estimated as shown in table1. The growth pattern of calves continuously and rapidly increased on weekly basis in response to milk replacer. The plotted graph is representing (Figure 1) more weight gained as compare to calves under dam feeding and the weekly average difference was recorded 0.446kg.

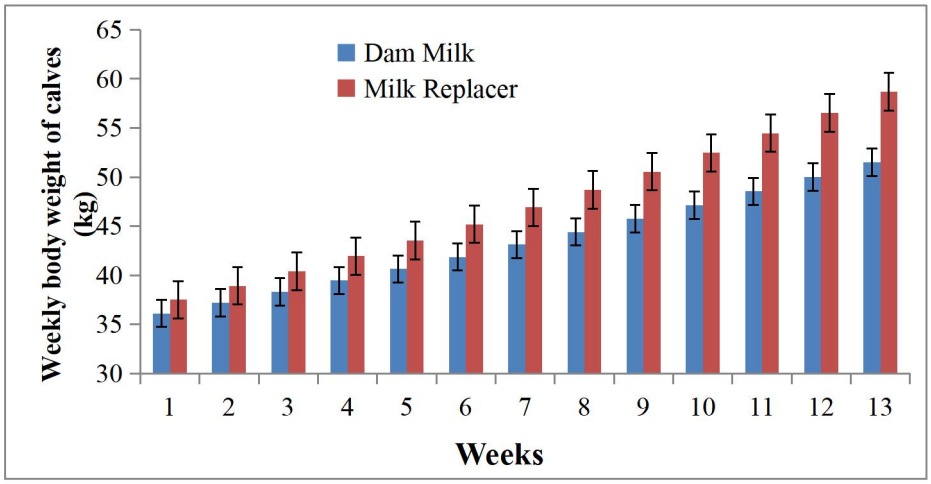


***FIGURE 1. COMPARISON OF WEEKLY BODY WEIGHT OF CALVES ON FEEDING PATTERNS***

**BODY CONFORMATION TRAITS**

**BODY LENGTH**

The calves fed on milk replacer and dam milk were measured for body length and the data are presented in table-2. The results indicated significant ($P<0.05$) difference in calf's body length when reared under different feeding patterns during thirteen weeks of experiment. At the end of first week of experiment, the average length of calves were increased 92.99 cm when fed with

milk replacer, and difference in length was recorded 6.90 cm between calves fed with dam milk and the milk replacer respectively.

Generally, during the thirteen weeks study, calves were succeeded to gain length of 24.94 cm in response to milk replacer as compare to fed dam milk, and the collectively difference was noted 8.09 cm. however, it seems that the milk replacer had a greater effectiveness on the development of the calves than those fed on dam milk.

**TABLE 2: WEEKLY BODY LENGTH (CM) OF HOLSTEIN FRIESIAN CALVES FED ON MILK REPLACER AS COMPARED TO MOTHER FEED**

| Weeks | Calves feeding system & body length (cm) | | Difference |
|---|---|---|---|
| | Mother feed | Milk Replacer | |
| 1 | 86.09 | 92.99 | 6.90 |
| 2 | 87.39 | 94.85 | 7.46 |
| 3 | 88.70 | 96.75 | 8.05 |
| 4 | 90.03 | 98.68 | 8.65 |
| 5 | 91.37 | 100.66 | 9.24 |
| 6 | 92.75 | 102.67 | 9.92 |
| 7 | 94.14 | 104.72 | 10.58 |
| 8 | 95.55 | 106.82 | 11.27 |
| 9 | 96.98 | 108.95 | 11.97 |
| 10 | 98.44 | 111.13 | 12.69 |
| 11 | 99.91 | 113.36 | 13.45 |
| 12 | 101.41 | 115.62 | 14.21 |
| 13 | 102.94 | 117.93 | 14.94 |
| **Total increase (13 weeks) cm** | **16.85** | **24.94** | **8.09** |
| **Av. Weekly increase (cm)** | **1.30** | **1.92** | **0.62** |
| **Av. Daily increase (cm)** | **0.185** | **0.274** | **0.089** |

| | Calf Feeding systems (S) | Weeks (W) | S*W |
|---|---|---|---|
| S.E. | 0.2182 | 0.5563 | 0.7868 |
| LSD 0.05 | 0.4319 | 1.1011 | 1.5571 |
| LSD 0.01 | 0.5708 | 1.4552 | 2.0980 |
| F-Value | 2415.78 | 296.95 | 11.17 |
| Probability | 0.0001 | 0.0001 | 0.0001 |
| Significance | ** | ** | ** |

The body length of calves showed statistically significant (P<0.05) differences between the milk replacer and dam milk groups, as well as across the weeks of testing. On the other hand, the calves demonstrated a significant (P<0.05) interaction between the feeding types and the number of weeks spent in trial. According to the findings, Holstein Friesian calves given milk replacer grew noticeably longer than those that were given milk from their mothers.

The continuous development on weekly basis in body length of calves against two feeding system is demonstrated in figure 2.

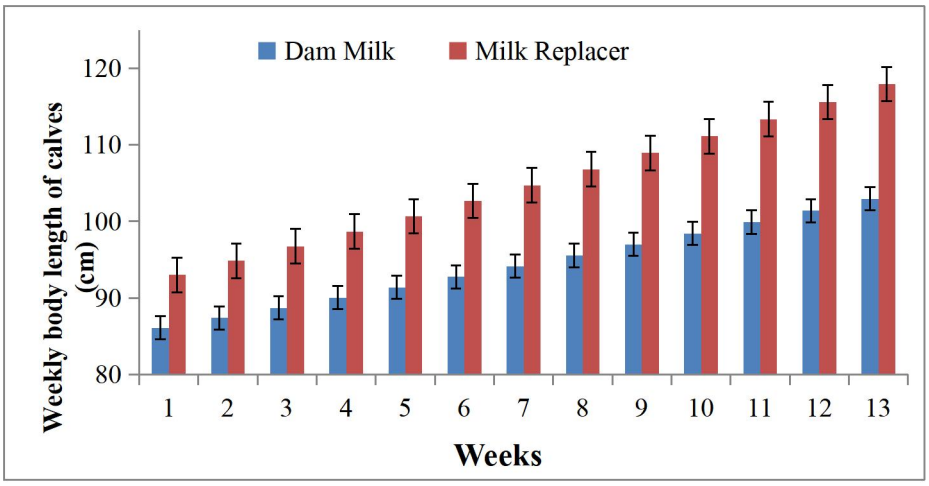


***FIGURE 2: COMPARISON OF WEEKLY BODY LENGTH OF CALVES ON FEEDING PATTERNS***

**BODY HEIGHT**

The data revealed a significant effect of feeding type on body height of Holstein Friesian calves reared under varied feeding systems during thirteen weeks of experiment (P<0.05). Under the treatment with milk replacer, the average height of calves was attained 23.20 cm followed by calves fed under dam feeding i.e. 15.67 cm during the thirteen weeks of experiment. This study

suggested that calves responded more favorably to milk replacer feeding in terms of their body height than they did when they were grown on dam milk alone (table 3).

**TABLE 3: WEEKLY BODY HEIGHT (CM) OF HOLSTEIN FRIESIAN CALVES FED ON MILK REPLACER AS COMPARED TO MOTHER FEED**

| Weeks | Calves feeding system & body height (cm) | | Difference |
|---|---|---|---|
| | Mother feed | Milk Replacer | |
| 1 | 80.06 | 86.48 | 6.42 |
| 2 | 81.27 | 88.21 | 6.94 |
| 3 | 82.49 | 89.98 | 6.49 |
| 4 | 83.72 | 91.77 | 8.05 |
| 5 | 84.98 | 93.61 | 8.63 |
| 6 | 86.25 | 95.48 | 9.23 |
| 7 | 87.55 | 97.39 | 9.84 |
| 8 | 88.86 | 99.34 | 10.48 |
| 9 | 90.20 | 101.33 | 11.13 |
| 10 | 91.55 | 103.35 | 11.80 |
| 11 | 92.92 | 105.42 | 12.50 |
| 12 | 94.32 | 107.53 | 13.21 |
| 13 | 95.73 | 109.68 | 13.95 |
| **Total increase (13 weeks) cm** | **15.67** | **23.20** | **7.53** |
| **Av. Weekly increase (cm)** | **1.21** | **1.79** | **0.58** |
| **Av. Daily increase (cm)** | **0.172** | **0.255** | **0.083** |

| | Calf Feeding systems (S) | Weeks (W) | S*W |
|---|---|---|---|
| S.E. | 0.2216 | 0.5650 | 0.7990 |
| LSD 0.05 | 0.4386 | 1.1181 | 1.5813 |
| LSD 0.01 | 0.5796 | 1.4778 | 2.0899 |
| F-Value | 2026.19 | 249.11 | 9.37 |
| Probability | 0.0001 | 0.0001 | 0.0001 |
| Significance | ** | ** | ** |

The ANOVA illustrated that calf body height varied significantly (P<0.05) between feeding systems and weeks of experiment as well as for their interaction. Irrespective of feeding system, the body height of calves increased with the development of age; and differences in body height between each successive week were statistically significant (P<0.05) as described by the LSD test.

The effect of milk replacer on the body height Holstein Friesian calves was investigated and the data showed that after 13 weeks of experiment the body height of calves was greater than those given dam milk; while the average weekly difference in calf body height given milk replacer was 0.58 cm and per day average difference in body height was 0.083cm over the calves given dam milk. It was noted that milk replacer was considerably influential to increase body height over dam milk feeding (figure 3).

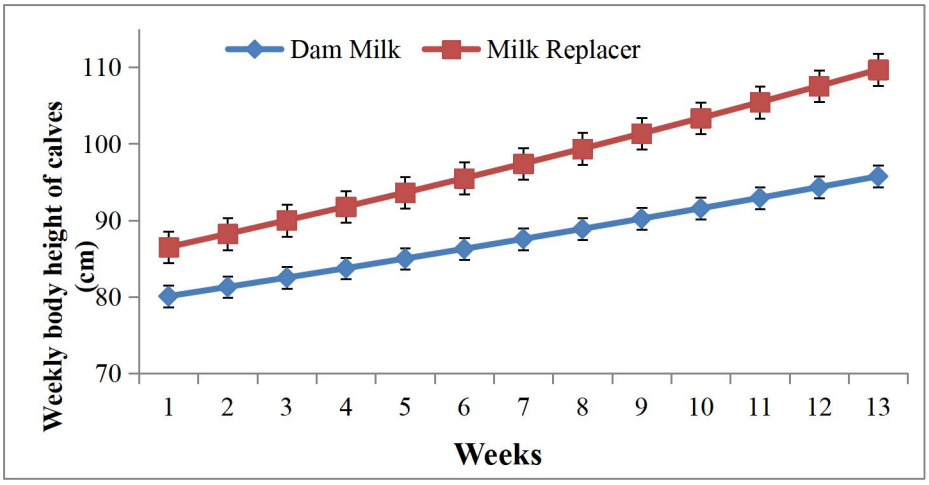


***FIGURE 3: COMPARISON OF WEEKLY BODY HEIGHT OF CALVES ON FEEDING PATTERNS***

**BODY WIDTH**

The body width of experimental calves kept under different feeding systems was measured at weekly interval till the thirteen weeks as shown in table-4. The results indicated significant (P<0.05) variation in body width of calves under milk replacer and dam milk feeding systems. The calves given milk replacer and dam milk had a body width of 16.22 cm and 10.95 cm respectively and the average difference was calculated as 5.27cm during the length of thirteen weeks.

**TABLE 7: WEEKLY BODY WIDTH (CM) OF HOLSTEIN FRIESIAN CALVES FED ON MILK REPLACER AS COMPARED TO MOTHER FEED**

| Weeks | Calves feeding system & body width (cm) | | Difference |
|---|---|---|---|
| | Mother feed | Milk Replacer | |
| 1 | 55.96 | 60.44 | 4.48 |
| 2 | 56.80 | 61.65 | 4.85 |
| 3 | 57.65 | 62.88 | 5.23 |
| 4 | 58.52 | 64.14 | 5.62 |
| 5 | 59.40 | 65.42 | 6.02 |
| 6 | 60.29 | 66.73 | 6.44 |
| 7 | 61.19 | 68.07 | 6.88 |
| 8 | 62.11 | 69.43 | 7.32 |
| 9 | 63.04 | 70.83 | 7.79 |
| 10 | 63.98 | 72.24 | 8.26 |
| 11 | 64.94 | 73.68 | 8.74 |
| 12 | 65.92 | 75.15 | 9.23 |
| 13 | 66.91 | 76.66 | 9.75 |
| **Total increase (13 weeks) cm** | **10.95** | **16.22** | **5.27** |
| **Av. Weekly increase (cm)** | **0.842** | **1.247** | **0.405** |
| **Av. Daily increase (cm)** | **0.120** | **0.178** | **0.058** |

| | Calf Feeding systems (S) | Weeks (W) | S*W |
|---|---|---|---|
| S.E. | 0.1248 | 0.3183 | 0.4581 |
| LSD 0.05 | 0.2471 | 0.6299 | 0.8908 |
| LSD 0.01 | 0.3265 | 0.8325 | 1.1774 |
| F-Value | 3118.43 | 383.39 | 14.43 |
| Probability | 0.0001 | 0.0001 | 0.0001 |
| Significance | ** | ** | ** |

According to the statistics analysis, calves that were given milk replacer grew more swiftly than those given mother feed. The analysis of variance demonstrated that the difference in the body width of calf was significant ($P<0.05$) between feeding systems and the weeks of experiment as well as for interactive effect of feeding systems in couple of weeks.

Regardless the feeding system, the body width of calves increased considerably with the advancement in their age (figure 4) and there was a successive and significant increase in body width when measured at weekly interval as suggested by LSD test.

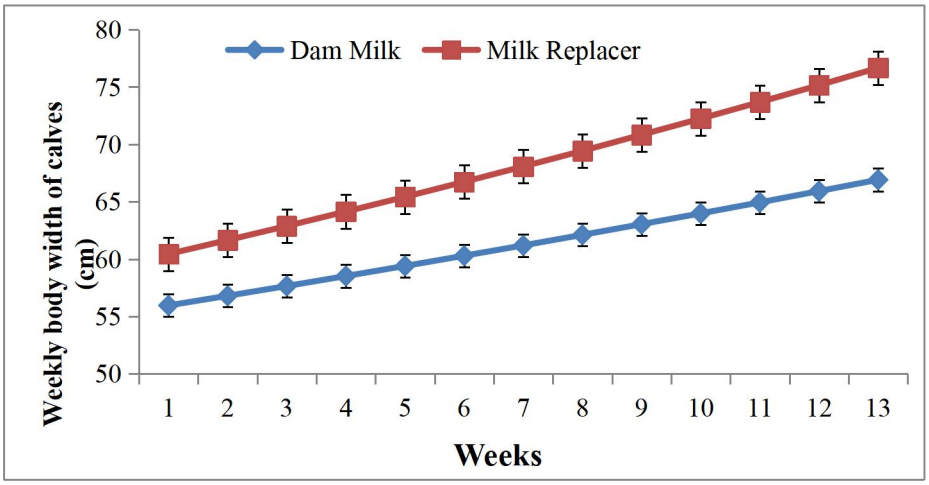


***FIGURE 4: COMPARISON OF WEEKLY BODY WIDTH OF CALVES ON FEEDING PATTERNS***

## DISCUSSION

Almost entire rural communities that raise livestock, particularly the large ruminants provide newborn calves with a variety of different types of nourishment in replacement of dam milk [16]. The farmers keep cows and buffalos for subsistence, and either they sell the milk or they use for household consumption. On the other hand, the commercial milk replacers and the feeding of similar products are relatively new ideas in Pakistan from a business perspective. Researchers have taken a significant interest in milk replacer feeding, which has prompted a variety of projects that attempt to assist dairy farmers in making use of it. The techniques of feeding had a substantial influence on the development and body conformation characteristics of cattle calf as observed in this study. The milk replacer compositions significantly differ from whole milk in their levels of energy, protein, and minerals. Energy source is one of the major differences, as milk replacer contains high levels of lactose, whereas whole milk contains higher

levels of fat [12].

Moreover, it was assumed that restrictive milk replacer feeding stimulates the solid feed intake in calves which should advance the rumen development, growth, and weight gain from starter feed which in turn reduce rearing costs [1, 17].

This study indicated that the development and body conformation of Holstein Friesian calves was greatly enhanced by using milk replacer against using dam milk. After thirteen weeks of trial, calves fed milk replacer had a greater average gain in weight (5.80 kg), length (8.09 cm), height (7.53 cm), and width (5.27 cm) than those that were fed dam milk. There was a difference of 0.446 cm in weight, 0.62 cm in length, 0.58 cm in height, and 0.405 cm in body width over the course of a week; the difference over the course of a day was 0.064 kg, 0.089 cm and 0.058 cm in weight, length, height, and width of body, respectively. The similar study was conducted on effect on milk replacer feeding levels during the fourteen weeks in heifer calves and our findings were very near to the previous study conducted by Seibt [18].

The growth and conformation of individual calves given a milk replacer was noticeably different from the development and conformation of those given dam milk. It was discovered that the growth and body conformation characteristics of calves were substantially different ($P<0.05$) depending on the feeding strategy. The development and body conformation of calves was greatly enhanced by using milk replacer as compared to dam milk. In addition, a significant number of researchers have investigated analogous aspects of cow breeds in various parts of the world, lending credence to the conclusions that have been presented here. Calves given milk replacer had a significant increase in weight growth prior to weaning compared to calves that were fed raw milk [19]. It is possible that this is related to the high level of nutrients found in milk replacers. Despite the fact that, previous studies demonstrated comparable increases in response to milk replacer [20, 21, 22]. According to other study findings, it is possible that part of the results' variability might be attributed to the tremendous improvement that has been made in the development of milk replacers over the last few years [19]. Concerning calves given milk replacer, the findings that were uncovered in this study were lower than those that were published by [23, 24]. It is probable that this is what happened since they carried out their investigation in a region with a temperate climate. Calves kept on milk replacer grew more swiftly than dam milk calves throughout the course of their first year of life. The weaning

weight of calves provided with milk replacer was significantly greater as compared to calves fed raw milk [19, 25]. Godden et al. [26] came up with a lower figure, whereas our research came up with a higher one. On the other hand, the value of a past study [27] was considerably less than that of this investigation. When compared to calves fed raw milk, those fed on milk replacer gained more weight than calves fed dam milk. The findings of this investigation were far more significant than those discovered by [22]. The cost of dry calf starter was significantly less as compared to those given milk replacer during the pre-weaning period; this may be due to the fact that calves given milk replacer consumed less dry calf starter than calves that are fed raw milk [19]. The findings of this study indicate that Holstein Friesian calves might benefit from being fed a milk replacer that has the appropriate chemical make-up. This would result in better calf growth than giving the calves' dam milk.

It is therefore concluded that the development and body conformation characteristics of Holstein Friesian calves were significantly impacted by the feeding regimens. The experimental calves responded better to feeding with milk replacer compared to those kept on dam milk. Fed on milk replacers, the calves exhibited a remarkable reactivity and used the feed in a more efficient manner. Growth and body conformation of calves increased significantly with age, despite the feeding regimen; however, the performance of calves given milk replacer was significantly superior to those handled under dam milk.

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