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EFFECT OF FEED ADDITIVES SUPPLEMENTS ON CARCASS WEIGHT, MEAT QUALITY AND BLOOD PARAMETERS OF MALE PATERI GOAT KIDS

Original Article

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ABSTRACT

Background: Goat farming plays a critical role in supporting rural livelihoods, with the Pateri goat breed being one of the most economically significant in Sindh, Pakistan. Feed additives like probiotics and yeast have shown promising effects in enhancing livestock productivity through improved metabolism, growth, and meat quality. However, limited data exists on their breed-specific effects under controlled intensive systems. This study was designed to fill this gap by evaluating the influence of dietary supplementation on male Pateri goat kids.

Objective: To assess the effects of dietary supplementation with probiotics and yeast on growth performance, carcass weight, meat quality, and blood parameters in male Pateri goat kids.

Methods: A total of twelve healthy, three-month-old male Pateri goat kids were randomly assigned into three groups (n=4): Group A (control), Group B (probiotics: *Bacillus subtilis* + *Lactobacillus acidophilus*, 2 g/head/day), and Group C (yeast: *Saccharomyces cerevisiae*, 2 g/head/day). All kids were raised under an intensive system for 90 days. Parameters assessed included body weight, length, height, heart girth, biochemical markers (glucose, BUN, cholesterol), carcass characteristics, and meat quality traits. Data were analyzed using ANOVA followed by LSD test (P<0.05).

Results: Group B exhibited significantly higher final body weight (18.20 ± 0.94 kg), length (58.25 ± 1.58 cm), height (63 ± 0.81 cm), and heart girth (61.52 ± 1.72 cm) than Group A (13.37 ± 1.86 kg, 51.75 ± 1.70 cm, 59 ± 2 cm, 55.5 ± 1.29 cm, respectively). Blood glucose was highest in Group A (80.5 ± 2.38 mg/dL), while BUN and cholesterol were highest in Group B (31.25 ± 2.63 mg/dL; 97.75 ± 16.18 mg/dL). Meat from Group B had higher protein (23.96 ± 0.85%), lower cooking loss (31.3 ± 4.01%), and better water holding capacity (62.76 ± 2.25%). Carcass weight and dressing percentage were also highest in Group B (9.6 ± 0.43 kg; 49%).

Conclusion: Probiotic supplementation significantly enhanced growth performance, metabolic efficiency, meat composition, and carcass traits in Pateri goat kids under intensive conditions.

Keywords: Blood parameters, Carcass weight, Feed additives, Meat quality, Pateri goat, Probiotics, Yeast.

INTRODUCTION

The goat population in Pakistan plays a significant role in the livelihood of rural communities, particularly in the Sindh province, which hosts 13 phenotypically distinct breeds. Among these, the Pateri goat stands out due to its massive body frame, adaptability, and versatility. This breed is predominantly found in the districts of Mirpurkhas, Hyderabad, Sanghar, Shaheed Benazirabad, and Khairpur (1). Despite the crucial role goats play in providing milk, meat, skins, and economic stability—especially in underprivileged areas where they are often referred to as the "poor man's cow"—there remains a pressing need to enhance their production potential through evidence-based nutritional strategies (2). Globally, the goat population approaches one billion, with over 90% residing in Asia and Africa, and only a minor fraction in Europe, reflecting the region-specific reliance on goat farming as a sustainable agricultural practice (3,4). In recent years, scientific interest has increasingly focused on the use of feed additives, particularly probiotics and yeast-based supplements, to improve livestock health and productivity. Probiotics derived from various sources—animal, human, or food origins such as raw milk and fermented products—have demonstrated positive impacts on growth performance, blood profiles, and meat characteristics in ruminants (5,6). Such benefits are largely attributed to enhanced gut microbiota balance, nutrient absorption, and immune modulation.

Furthermore, supplementation with yeast as a probiotic has been associated with improved feed efficiency and economic viability in small ruminants. However, the extent of these benefits can vary significantly depending on the yeast strain, dosage, dietary fiber content, and duration of supplementation (7,8). Some studies have reported promising effects of yeast supplementation on carcass traits, but findings remain inconsistent across different breeds and management conditions (9,10). This highlights a knowledge gap in breed-specific responses to nutritional interventions, particularly in indigenous goat breeds such as the Pateri. Given the economic and nutritional importance of goats and the increasing interest in natural growth promoters, it is essential to validate the efficacy of such feed additives under controlled management systems. The current study was therefore designed to investigate the effects of feed additive supplementation on carcass weight, meat quality, and blood parameters of male Pateri goat kids raised under an intensive management regime, aiming to inform more sustainable and productive feeding practices for this valuable breed.

METHODS

The present experimental study was carried out at the Livestock Experiment Station, Department of Livestock Management, Faculty of Animal Husbandry, Sindh Agriculture University, Tandojam, to investigate the effects of feed additive supplementation on carcass weight, meat quality, and blood parameters in male Pateri goat kids under an intensive management system. The trial was conducted over a period of 90 days, following an initial 15-day adaptation period. A total of twelve clinically healthy, three-month-old male Pateri goat kids of similar body weight and condition score were selected for inclusion. The kids were randomly allocated into three treatment groups, each comprising four animals: Group A (control), Group B (probiotic-supplemented), and Group C (yeast-supplemented). Animals showing signs of illness or metabolic disorders were excluded prior to enrollment to avoid confounding effects. Throughout the study period, all animals were maintained under similar environmental conditions and housed individually to allow for accurate feed intake monitoring. Group A (control) received a standard diet comprising green fodder and concentrate feed. Group B received the same basal diet with an additional supplementation of probiotics containing *Bacillus subtilis* and *Lactobacillus acidophilus* at a dosage of 2 g/head/day. Group C received the basal diet plus *Saccharomyces cerevisiae* yeast supplementation at 2 g/head/day. All feed additives were administered orally once daily during the morning feeding. Nutritional formulation and feeding plans were balanced according to standard nutrient requirements for growing goats to ensure that all groups received equivalent energy and protein levels, with the only difference being the respective additives.

Body weight measurements were recorded using a digital weighing balance at the start of the trial, every fortnight, and at the end of the experiment to monitor growth trends. Following the 90-day feeding regimen, all kids were humanely slaughtered for carcass evaluation. Carcass weight (in kilograms) was determined post-slaughter. For meat quality assessment, physical and chemical characteristics of the longissimus dorsi muscle were analyzed. Physical parameters such as pH, water-holding capacity, cooking loss, and drip loss were evaluated following standardized procedures as described (7–10). Chemical composition, including moisture, crude protein, fat, ash, and carbohydrate content, was analyzed using AOAC methods (2000), including the Kjeldahl method for protein determination, Soxhlet extraction for fat, and gravimetric techniques for ash content (11). To assess the influence of dietary supplementation on physiological status, blood samples were collected from the jugular vein of each animal at days 0, 30, 60, and 90 using vacutainer tubes containing EDTA as an anticoagulant. The collected samples were transported to the Veterinary Diagnostic Laboratory in Tandojam for the analysis of blood biochemical parameters, including glucose, total cholesterol, triglycerides, and blood urea nitrogen. All laboratory procedures were conducted under standardized diagnostic protocols to ensure accuracy and repeatability. Data were compiled, cleaned, and subjected to statistical analysis using STATISTIX version 8.1 (Analytical Software, USA, 2005). A one-way analysis of variance (ANOVA) was employed to determine the effects of treatment groups on all measured parameters. Where statistically significant differences were observed, mean separation was performed using the Least Significant Difference (LSD) test at a 95% confidence level. Ethical approval for animal use and experimental procedures was obtained from the Institutional Animal Ethics Committee of Sindh Agriculture University, Tandojam and informed consent was taken from the station authority responsible for animal care and use.

RESULTS

The findings of the present study demonstrated that supplementation with probiotics and yeast significantly influenced the growth performance, carcass characteristics, blood parameters, and meat quality of male Pateri goat kids raised under an intensive management system. The final body weight of goat kids showed a statistically significant difference across the treatment groups, with the probiotic-supplemented group attaining the highest mean body weight of 18.20 ± 0.94 kg, followed by the yeast group at 16.45 ± 0.99 kg, and the control group at 13.37 ± 1.86 kg (P = 0.0013). Similarly, body length was also highest in the probiotic group at 58.25 ± 1.58 cm, with yeast and control groups measuring 57.55 ± 1.29 cm and 51.75 ± 1.70 cm, respectively (P = 0.0003). A consistent pattern was observed in heart girth and body height parameters, with the probiotic group again outperforming other groups (P < 0.05). Blood biochemical analysis revealed that glucose levels were significantly reduced in the probiotic and yeast groups by day 90, with the control group recording the highest level of 80.5 ± 2.38 mg/dL, compared to 73.25 ± 2.87 mg/dL and 68.5 ± 3.56 mg/dL in probiotic and yeast groups, respectively (P = 0.007). Blood urea nitrogen levels were elevated in all groups by day 90 but remained highest in the probiotic group at 31.25 ± 2.63 mg/dL. Although cholesterol levels increased progressively, only modest and non-significant differences were noted among the groups by day 90 (P = 0.1309), with values of 79.55 ± 11.68 mg/dL, 97.75 ± 16.18 mg/dL, and 86.25 ± 14.97 mg/dL for control, probiotic, and yeast groups, respectively.

Evaluation of meat composition showed superior nutritional quality in the probiotic group. Protein content was highest in this group at 23.96 ± 0.85%, compared to 21.10 ± 0.10% in the yeast group and 18.88 ± 0.50% in the control group (P = 0.0021). The fat percentage was also greater in the probiotic group (2.97 ± 0.15%) relative to yeast (1.60 ± 0.20%) and control (1.5 ± 0.20%) groups. Water holding capacity was significantly enhanced in probiotic-fed goats (62.76 ± 2.25%), while the lowest value was observed in the control group (46.16 ± 0.76%) (P = 0.0044). Drip loss and cooking loss were markedly reduced in the probiotic group, suggesting improved meat water retention and tenderness. In terms of carcass yield, probiotic supplementation significantly enhanced pre-slaughter and dressed carcass weights. Kids in the probiotic group achieved the highest pre-slaughter weight of 18.23 ± 0.94 kg and carcass weight of 9.60 ± 0.43 kg, resulting in a dressing percentage of 49%, which was significantly higher than yeast (45%) and control (42%) groups (P = 0.0004). Additionally, organ weights, including head, neck, thorax, loin, and edible organs, were significantly higher in the probiotic group, particularly loin and flank which weighed 2.73 ± 0.06 kg compared to 1.54 ± 0.14 kg in the control group (P < 0.05).

Table 1: Growth Performance Indicators of Male Pateri Goat Kids under Intensive Management System with Probiotic and Yeast Supplementation

Day	Parameter	Group A (Control)	Group B (Probiotic)	Group C (Yeast)	S.E	P value
Initial	Body Weight (kg)	8.31 ± 1.91	8.55 ± 0.91	8.57 ± 1.17	0.69757	0.9538
	Body Length (cm)	39.25 ± 1.53	40.75 ± 1.26	40.53 ± 1.29	0.677	0.2935
	Body Height (cm)	46.75 ± 2.22	48.00 ± 1.15	47.00 ± 0.82	0.7592	0.4959
Day 15	Body Weight (kg)	9.02 ± 1.87	9.92 ± 0.84	10.02 ± 1.07	0.66797	0.5309
	Body Length (cm)	41.51 ± 1.29	43.85 ± 1.80	42.75 ± 1.71	0.68211	0.1674
	Body Height (cm)	48.25 ± 2.22	50.00 ± 1.15	48.75 ± 1.26	0.80795	0.3332
Day 30	Body Weight (kg)	9.85 ± 1.81	11.55 ± 0.83	11.52 ± 1.09	0.65675	0.1666
	Body Length (cm)	43.52 ± 1.29	46.51 ± 1.29	45.75 ± 1.71	0.72179	0.0404
	Body Height (cm)	50.25 ± 1.50	52.75 ± 0.96	51.25 ± 1.50	0.67185	0.0748
Day 45	Body Weight (kg)	10.65 ± 1.86	13.15 ± 0.75	13.48 ± 1.09	0.65828	0.0434*
	Body Length (cm)	45.51 ± 1.29	49.55 ± 1.29	48.75 ± 1.71	0.72179	0.0079
	Body Height (cm)	52.00 ± 1.41	55.75 ± 0.96	53.75 ± 1.26	0.61237	0.0063*

Day	Parameter	Group A (Control)	Group B (Probiotic)	Group C (Yeast)	S.E	P value
Day 60	Body Weight (kg)	11.37 ± 1.82	14.72 ± 0.73	14.47 ± 1.03	0.63950	0.0084*
	Body Length (cm)	47.75 ± 1.71	52.25 ± 1.53	51.75 ± 1.71	0.82074	0.0071
	Body Height (cm)	54.25 ± 1.71	58.75 ± 0.96	56.00 ± 1.63	0.73598	0.0041*
Day 75	Body Weight (kg)	12.35 ± 1.94	16.32 ± 0.85	15.97 ± 1.03	0.68038	0.0045*
	Body Length (cm)	49.75 ± 1.71	55.25 ± 1.57	54.75 ± 1.71	0.82074	0.0018*
	Body Height (cm)	56.25 ± 2.22	61.00 ± 0.82	58.50 ± 1.29	0.77728	0.0049*
Day 90	Body Weight (kg)	13.37 ± 1.86	18.20 ± 0.94	16.45 ± 0.99	0.66745	0.0013*
	Body Length (cm)	51.75 ± 1.71	58.25 ± 1.59	57.55 ± 1.29	0.75462	0.0003*
	Body Height (cm)	59.00 ± 2.00	63.00 ± 0.82	61.25 ± 0.96	0.68211	0.0058*

Table 2: Heart girth (cm) of pateri male goat kids reared under intensive management system

Groups	A(control)	B(Probiotic)	C(Yeast)	S. E	P value
Initial	44.0±1.82574	46.25±2.75379	46.30±0.81655	0.98249	0.259
Day 15	45.7±1.55212	48.51±2.38048	48.13±0.81655	0.84574	0.1004
Day 30	48.0±1.82574	51.25±2.21736	50.25±1.25831	0.90523	0.0803
Day 45	49.5±1.29099	54.48±2.16025	52.25±1.25831	0.81233	0.0108*
Day 60	51.5±1.29099	56.52±1.73205	54.75±1.27654	0.71686	0.0036*
Day 75	53.5±1.29099	58.77±1.55641	56.75±1.29896	0.7592	0.0019*
Day 90	55.5±1.29099	61.52±1.72050	59±11.414212	0.74536	0.001*

Table 3: Blood Biochemical Parameters of Male Pateri Goat Kids under Probiotic and Yeast Supplementation in Intensive Management System

Day	Parameter	Group A (Control)	Group B (Probiotic)	Group C (Yeast)	S. E	P value
Initial	Glucose (mg/dL)	71.60 ± 3.16	63.25 ± 9.57	59.25 ± 2.22	2.997	0.058
	BUN (mg/dL)	10.65 ± 6.25	6.42 ± 0.42	12.02 ± 6.45	2.594	0.328
	Cholesterol (mg/dL)	62.25 ± 17.23	78.75 ± 18.92	70.51 ± 16.19	8.744	0.4439
Day 30	Glucose (mg/dL)	70.75 ± 2.22	62.50 ± 3.87	61.25 ± 2.36	1.457	0.0025*
	BUN (mg/dL)	11.92 ± 6.44	15.75 ± 8.73	16.47 ± 6.90	3.711	0.66
	Cholesterol (mg/dL)	72.50 ± 13.44	76.75 ± 15.75	75.53 ± 15.89	7.536	0.9044
Day 60	Glucose (mg/dL)	76.75 ± 3.77	68.75 ± 4.03	61.25 ± 4.57	2.070	0.0017*
	BUN (mg/dL)	21.25 ± 6.34	22.75 ± 2.22	20.25 ± 4.43	2.322	0.752
	Cholesterol (mg/dL)	77.75 ± 11.61	83.25 ± 13.88	84.25 ± 14.17	6.638	0.7636
Day 90	Glucose (mg/dL)	80.50 ± 2.38	73.25 ± 2.87	68.50 ± 3.56	1.488	0.007*
	BUN (mg/dL)	31.25 ± 2.63	26.75 ± 2.99	27.25 ± 2.55	1.356	0.083
	Cholesterol (mg/dL)	79.55 ± 11.68	97.75 ± 16.18	86.25 ± 14.97	5.755	0.1309

Table 4: Meat composition of male pateri goat kids reared under intensive management system

Groups	A (control)	B (Probiotic)	C (Yeast)	S. E	P value
Ash	1±0.10	1.3±0.200	1.1±0.100	0.124	0.16
CL	43.95±0.45	31.3±4.006	41.763±0.465	1.673	0.003
Carb	0.966±0.057	1.566±0.251	1.166±0.057	0.141	0.031
DL	5.45±0.050	2.360±0.135	3.866±0.305	0.123	0.001
Fat	1.5±0.200	2.966±0.152	1.600±0.200	0.178	0.0021
Protein	18.88±0.500	23.96±0.85	21.10±0.100	0.566	0.0021
TS	22.26±0.251	29.66±1.25	25.50±0.10	0.64	0.0008
WHC	46.16±0.763	62.76±2.25	51.36±0.10	2.267	0.0044
PH	5.67±0.075	5.52±0.02	5.72±0.07	0.046	0.0279

Table 5: Carcass Weight & Dressing percentage of male Pateri goat kids

Carcass characteristics (Kg)	Group A Control	Group B (Probiotics)	Group C (Yeast)	S. E	P-Value
Initial body weight	08.31±1.9078	8.55±0.91469	8.575±1.1672	0.69757	0.9538
Pre- slaughter weight	13.34±1.8625	18.23±0.94163	16.45±0.9949	0.66745	0.0013*
Dressed carcass	5.81±0.740	9.6±0.432	8.026±0.1551	0.29062	0.0006*
Dressing percentage (%)	42±1.0	49±1.0	45±1.0	0.57735	0.0004*

Table 6: Showing the Weight of Organs of Pateri male goat kids reared under intensive management system

Groups	A(control)	B(Probiotic)	C(Yeast)	S. E	P value
Weight of Head	0.833±0.094	1.4±0.1	1.333±0.057	0.494	0.004*
Weight of Neck, shoulder and thorax	1.903±0.041	3.066±0.028	2.866±0.152	0.053	0.001*
Weight of loin and flank	1.543±0.140	2.73±0.0608	2.533±0.152	0.072	0.001*
Weight of legs	1±0.087	1.23±0.157	1.133±0.152	0.078	0.196
Weight of edible organ	0.416±0.025	0.543±0.208	0.42±0.02	0.012	0.006*

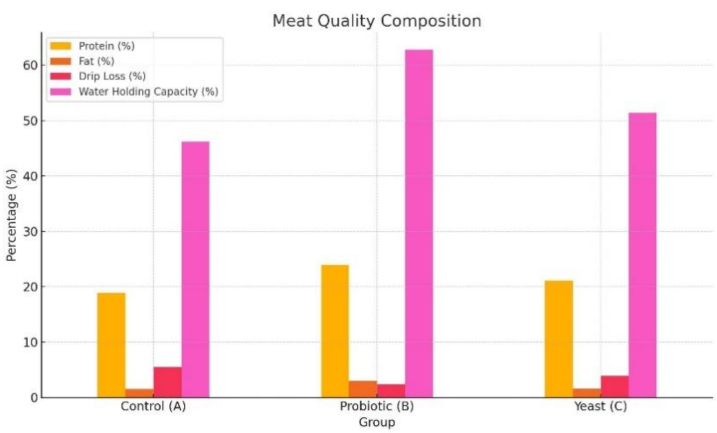

Figure 1 Meat Quality Composition

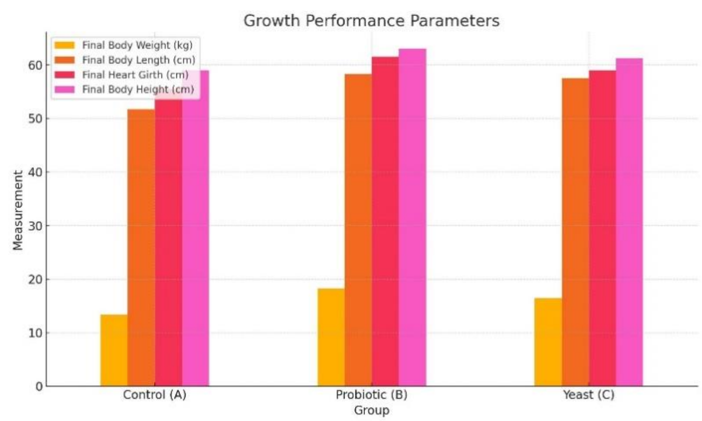

Figure 2 Growth Performance Parameters

DISCUSSION

The findings of the present study highlighted the significant impact of dietary supplementation with probiotics and yeast on growth performance, biochemical indices, meat quality, and carcass characteristics in male Pateri goat kids. Among the groups, probiotic supplementation demonstrated the most pronounced improvements, indicating enhanced nutrient utilization and physiological development under intensive management conditions. These outcomes are in agreement with previously documented research showing that probiotic-fed ruminants experience improved feed efficiency, weight gain, and growth trajectories. Probiotics likely exerted these effects by modulating gut microbiota, improving nutrient absorption, and enhancing immune function. Although yeast supplementation also contributed to moderate improvements, its effect was less substantial compared to probiotics, aligning with previous comparative studies in small ruminants. The biochemical analysis further supported the physiological benefits of supplementation (12-14). Notably, blood glucose levels were significantly lower in the treated groups than in the control, suggesting more efficient glucose metabolism and utilization. This may reflect improved ruminal fermentation, leading to enhanced gluconeogenesis and energy balance. However, inconsistent findings in prior studies regarding the effects of probiotics on glucose levels indicate that such outcomes may vary with the strain of microorganism, dosage, and duration of supplementation (15,16). Blood urea nitrogen and cholesterol levels showed fluctuating trends without consistent statistical significance, suggesting that while microbial additives can influence metabolic parameters, their effects may be more subtle or context-dependent, requiring further biochemical profiling for definitive conclusions (17).

The study also revealed that probiotic supplementation significantly improved several meat quality parameters, including protein content, water holding capacity, and reduced fat and drip losses. These improvements are highly relevant to consumer preferences and commercial meat production standards (18,19). Meat from probiotic-supplemented goats presented better compositional traits, reflecting not only enhanced muscle accretion but also favorable postmortem biochemical transformations. These traits correspond with enhanced carcass quality, as evidenced by higher carcass weights, improved dressing percentages, and heavier organ weights (20). Such findings imply that probiotics not only affect systemic metabolism but also contribute to tissue-specific development and meat yield optimization. Although yeast-fed goats showed moderate enhancements in meat quality, the effects were less pronounced, indicating a relatively limited scope of benefit compared to probiotic use (21,22).

Strengths of the study include the use of a controlled experimental design, standardized feeding protocols, and comprehensive assessment of growth, carcass, and blood parameters, which collectively strengthen the reliability of findings. The utilization of a local breed under intensive management also enhances the relevance of results to regional livestock production systems. However, the study was limited by a small sample size, which could restrict the generalizability of results. Furthermore, sensory evaluation of meat quality, hematological profiling, and microbial analysis of gut flora were not conducted, all of which could have enriched the understanding of physiological changes induced by feed additives. Additionally, the duration of the study, although adequate to observe growth responses, may have been insufficient to capture long-term effects on reproductive performance or health outcomes. Future research should explore the strain-specific effects of probiotics and yeast in larger and more diverse animal cohorts. Investigations into gut microbiota modulation, immune biomarkers, and nutrient digestibility would provide mechanistic insights into the observed outcomes. Comparative studies involving other indigenous breeds and extensive or semi-intensive systems could further validate the scalability of these findings. Inclusion of meat palatability assessments and cost-benefit analyses would also enhance the translational value of feed additive interventions in commercial goat farming. In summary, the study supports the efficacy of probiotic supplementation in improving growth, metabolic health, and carcass traits in Pateri goat kids, while also acknowledging the moderate yet positive role of yeast. These findings hold significant promise for enhancing meat production efficiency and animal health in small ruminant farming.

CONCLUSION

In conclusion, the supplementation of probiotics alongside concentrate and green fodder significantly enhanced the overall growth performance, physiological parameters, and meat quality of male Pateri goat kids under intensive management. Compared to the control and yeast-supplemented groups, probiotics contributed to better body development, improved metabolic efficiency, and superior carcass traits. These findings underscore the practical value of incorporating probiotics into feeding regimes for optimizing productivity and meat yield in small ruminant farming, offering a sustainable approach to improving livestock performance in regional goat production systems.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Saleem	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Shakeel Ahmed Tunio	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Huma Rizwana	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Ghulam Shabir Barham	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mansoor Ahmed*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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