

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.709.224>

Effect of Wet Rice Distillers Grain and Solubles on Milk Production and Composition in Lactating Cows

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ABSTRACT

Keywords

Wet Rice Distiller Grains and Soluble (WRDGS), Solid Not Fat (SNF), Lactating cows

Article Info

Accepted:
12 August 2018
Available Online:
10 September 2018

A study was conducted in lactating dairy cows to evaluate the effect of wet rice distillers' grain and soluble (WRDGS) on milk production and composition. Forty (40) lactating Jersey cows, in mid-lactation with an average live weight 350 kg and producing 8-9 kg milk daily were divided into two groups consisting of twenty animals in each group having 4 replicates with 5 animals in each. The control group cows were individually fed 6.0 kg concentrate and 4.0 kg straw whereas treatment group cows were fed 4.0 kg concentrate, 5.0 kg straw and 4.0 kg wet rice distiller grains and soluble. The results indicated that milk yield, milk fat, milk protein and lactose percentage was not significantly ($p>0.05$) affected by feeding of WRDGS. However, total solid and SNF percentage was significantly increased in the experimental group. The WRDGS fed cows consumed less dry matter without affecting its milk production, reflecting better economic gain per animal in experimental feeding than control.

Introduction

Distiller's grain is a co-product of ethanol industry in which corn is being used for ethanol production in the United States (Birkelo *et al.*, 2004). Rice distillers' grain (Rice cake) is a by-product of the processing of rice grain which is produced from the distillation of fermented rice, an important by-product of the distillers industries in Asian countries. It contains a valuable source of supplemental protein with high rumen degradability (Warner, 1970). It also contains other nutrients recovered from fermented rice. These include low soluble carbohydrate and fibre, high fat and factor (live yeast) that

stimulate cellulose digestion in the rumen. The nutrient content and feeding value of rice distillers' grain is expected to be different from commercially available source since the ingredients for rice wine production include primarily rice grain with only a little amount of corn.

Rice distillers' grain as often fed as wet to avoid drying cost. Both wet and dried corn distillers grain supported similar milk production and composition (Al-Suwaiegh *et al.*, 2002). There is dearth of information on the feeding and nutritional value of this important by-product from rice. Therefore, the present study was planned to evaluate the use

of wet rice cake as a part of concentrate in lactating dairy cows based on milk yield, composition, feed intake and economic gain.

Materials and Methods

A sixty days feeding trial was conducted on forty (40) lactating Jersey cows in their mid-lactation with an average live weight 350 kg and producing 8-9 kg milk, at a private Dairy farm near Dum Dum Airport, Kolkata. The cows were divided into two groups consisting twenty animals in each group. Each group had four replicates with five animals in each. One common concentrate diet was formulated comprising de-oiled rice bran (DORB), gram chuni, arhar chuni, crushed maize, pea husk, mineral mixture and common salt. The ingredient composition and their cost are presented in table 1. The concentrate diet and roughage (straw) was fed to both control and experimental animals separately and only a portion (one-third) of concentrate is replaced by wet rice cake.

The cows were dewormed monthly during the experimental period and confined for individual feeding. After one week of adaptation period, the cows were subjected to a sixty days feeding trial. These cows were individually fed 6.0 kg concentrate diet and 4.0 kg straw in control group whereas the treatment group was offered 4.0 kg of concentrate, 4.0 kg of wet rice cake (about 75% moisture) and 5.0 kg straw. Water was provided individually with an automatic channel type drinker.

The cows were milked twice daily at 6.00 and 18.00 hr. During the feeding period dry matter intake and milk yields were recorded daily. The dry matter intake was calculated from the amount of dry matter present in feed offered, subtracted from the dry matter present in the refusal. Monthly milk samples were collected for chemical analysis of milk fat, milk protein,

SNF, milk total solids, lactose and ash content. Economic gain per animal was calculated on the basis of feed cost of each group animals. Both cost of wet rice cake and straw was Rs. 5.00 per kg.

Total fat percentage of milk was determined by Gerber method cited in ISI (1977). Milk protein percentage was estimated by conventional micro-Kjeldahl digestion and distillation procedure (AOAC, 1980). Percentage of lactose was assayed by Picric acid method as described by Perry and Doan (1950). Gravimetric method as cited in ISI (1981) was followed for determining the total solid content in milk. Estimation of ash (mineral) content was done by the method described in the manual of Dairy Chemistry (1962) published by Nation Dairy Research Institute, Karnal. The data collected were subjected to statistical analysis with GLM procedure of SPSS (Version 10.0) with Least Square ANOVA on cow, group and period.

Results and Discussion

The effect of WRDGS inclusion in the diet of lactating cows and their performances is presented in Table. 2. The dry matter intake was significantly reduced ($P < 0.05$) in WRDGS group in both 1st and 2nd month. The decrease in DM intake was 0.62 kg for the 1st month and 0.51 kg for the 2nd month as compared to control. The dry matter intake did not improve in second month both in control and treatment group. The present finding corroborates the findings of Schingoethe *et al.*, (1999) who reported significantly ($P < 0.05$) lower DMI in corn distiller's grain fed Holstein cows than control. Hippen *et al.*, (2003) and Kalscheur *et al.*, (2004) also reported that the moisture content added to the diet by feeding wet distillers grains and soluble at 30% of dry matter decreased dry matter intake. Haung *et al.*, (1999) noted that dry matter intake was progressively depressed

($p < 0.05$) when the level of dried rice distiller's grain inclusion in the diet increased. Birkelo *et al.*, (2004) found significant ($P < 0.01$) decrease in dry matter intake when Holstein cows were fed with corn distiller's grain.

Milk yield per day was not significantly ($P > 0.05$) affected by feeding wet rice distiller's grain and soluble (WRDGS) in lactating cows. Milk yield was comparatively higher (8.55 vs. 8.70 kg/day) and (8.65 vs. 8.85 kg/day) during first month and second month both in control and treatment group, respectively. Higher milk yield in treatment group might be due to higher protein content in rice distiller's grain and live yeast from WRDGS which helped in nutrient utilization. The present findings corroborated with the results of Power's *et al.*, (1995) who used soybean meal and distillers grain diet as protein sources and found diet containing DDGS yielded 0.80kg more milk/day than control in lactating cows fed soybean meal diets.

Anderson *et al.*, (2006) also found higher milk yield by feeding 10 or 20% wet and dry distillers' grains plus soluble than control but the level and form (wet or dry) did not show any significant difference in milk yield. Kleinschmit *et al.*, (2006) found higher milk yield (34.6 vs. 31.2 kg/day) in cows fed diets containing dried distillers grains and soluble.

Effect of inclusion of wet rice distiller's grain and soluble (WRDGS) in the diet significantly influenced the percentage of milk protein, total solid and solids not fat. The main effects of treatment did not affect the percentage of milk fat (3.76 vs. 3.77%) when WRDGS was included in the ration, explanation of which was not apparent. The present finding is in agreement with Al-Suwaiegh *et al.*, (2002) who showed similar milk fat percentage when wet and dry corn distiller's grain were used in dairy ration.

Milk protein percentage increased numerically (3.34 vs. 3.32 and 3.35 vs. 3.34) in the treatment group, however the effect was found to be non-significant ($P > 0.05$). A depression effect for nonstructural carbohydrate on milk protein was observed due to the low availability of carbohydrates, immediate energy source for microbial protein synthesis and growth in the rumen (Spicer *et al.*, 1986). Tessman *et al.*, (1991) also demonstrated a decrease in milk protein by decreasing concentrate supplements in the diet. Palmquist and Moser (1981) suggested that fat inclusion in the diet may interfere with the insulin functions that influence amino acid transfer into the mammary gland, hence the decline in milk protein synthesis. Van Horn *et al.*, (1985) observed a depression in milk protein percentage for cows fed DDGS from ethanol production relative to those fed soybean meal.

This effect was attributed to unavailable dietary protein and lower energy intake and unbalanced supply of amino acid particularly lysine in the DDGS diet. However, in the present study milk protein percentage was not affected which might be due to higher energy and protein content and balanced amino acids in rice distillers' grains. Schingoethe *et al.*, (1999) and Birkelo *et al.*, (2004) demonstrated a decrease in milk protein percentage in Holstein cows feeding wet corn distillers' grain whereas Kleinschmit *et al.*, (2006) also reported the same by feeding various sources of DDGS.

No significant change of milk lactose percentage irrespective of feeding wet rice distiller's grain and soluble could be observed during 1st and 2nd month of experiment in both control and treatment groups. The present experiment corroborated with the results of Schingoethe *et al.*, (1999) and Birkelo *et al.*, (2004) who did not found any change in milk lactose percentage in Holstein cows by feeding wet corn distiller's grain.

Table.1 Ingredients composition of concentrate diet for farm lactating dairy cows and their costs

Ingredients	Cost/kg (Rs)	Inclusion (kg/100kg)	Total cost (Rs)
DORB	9.00	42	378.00
Gram chuni	18.00	15	270.00
Arhar chuni	20.00	10	200.00
Crushed maize	15.00	15	225.00
Pea husk	13.00	15	195.00
Mineral mixture*	70.00	2	140.00
Common salt	5.00	1	5.00
Total	-	100	1413.00

* Each kg contains: CuSO₄, 5H₂O-15.3 g, ZnSO₄, H₂O-40.8 g, MnSO₄, H₂O-41.32 g, CoCl₂, 6H₂O-1.08 g, KI-62 mg, and DCP-901.5 g

Table.2 Performance of lactating dairy cows by feeding wet rice distiller's grain and soluble at farm level

Items	Month	Control	Treatment	SEM	P Value
Dry matter intake (kg)/day/animal	1 st	9.04	8.42	0.121	0.002
	2 nd	8.98	8.47	0.113	0.011
Milk yield (kg)/day/animal	1 st	8.55	8.65	0.130	0.724
	2 nd	8.70	8.85	0.094	0.461
Milk Composition (%)					
Fat	1 st	3.76	3.77	0.011	0.690
	2 nd	3.75	3.77	0.011	0.228
Protein	1 st	3.32	3.34	0.011	0.060
	2 nd	3.34	3.35	0.015	0.065
Lactose	1 st	4.47	4.47	0.007	0.869
	2 nd	4.47	4.46	0.011	0.617
Total Solid	1 st	12.13	12.21	0.023	0.004
	2 nd	12.14	12.25	0.028	0.735
Solid Non Fat	1 st	8.38	8.44	0.023	0.021
	2 nd	8.39	8.49	0.029	0.456
Ash	1 st	0.61	0.62	0.004	0.501
	2 nd	0.61	0.62	0.004	0.501
Feed cost (Rs.)/day/animal	1 st	109.04	100.46	0.806	0.001
	2 nd	108.34	100.56	0.777	0.003
Economic gain (Rs)/day/animal	1 st	-	8.58	-	-
	2 nd	-	7.78	-	-

Anderson *et al.*, (2006) and Kleinschmit *et al.*, (2006) also found similar findings by feeding various sources of wet and dry DGS in lactating dairy cows.

Total milk solid and solid not fat was significantly ($P < 0.05$) varied in 1st month of experiment but no change was observed in 2nd month. Total solid percentage in treatment

group (12.21 vs. 12.13) and SNF was also found higher (8.44 vs.8.38) in the 1st month. It was not clear why only 1st month of experimental period showed higher total solid and SNF percentage in treatment group. Haung *et al.*, (1999) did not observe any change in solid not fat in Holstein cows fed 10% dried rice distiller's grain but slightly decrease in SNF % when the inclusion level was 20%. No significant change in milk ash percentage was observed both in control and treatment group.

The average feed cost for control and treatment groups were Rs. 108.64 and 100.46 for 1st month and the same were Rs. 108.34 and 100.56 for 2nd month. The economic gain per day per animal was Rs. 8.58 in 1st month and Rs. 7.78 in 2nd month when compared with control. It was concluded that wet rice cake can replace near about one-third portion of concentrate mixture without any adverse effect on milk yield, milk fat%, milk protein, milk ash% and lactose. Moreover, despite of less dry matter intake, wet rice cake (WRDGS) significantly influenced total solid and solid not fat. The economics of gain in terms of feed cost was comparable with control group.

Acknowledgements

Appreciation is extended to ICAR for providing all financial and laboratory support from AICRP on "Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production" WBUAFS, Kolkata and Md. Chand for providing permission to conduct the research work at Ganganagar Dairy Farm, Dum Dum.

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How to cite this article:

Pakhira, M.C. and Biswas, P. 2018. Effect of Wet Rice Distillers Grain and Solubles on Milk Production and Composition in Lactating Cows. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 1845-1850. doi: <https://doi.org/10.20546/ijemas.2018.709.224>