Dietary *Saccharomyces cerevisiae* supplementation improves feed intake and milk quality of dairy cows

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ABSTRACT

The objective of this study was to evaluate the effects of daily dietary supplementation of *Saccharomyces cerevisiae*-contained product (SCP) on feed consumption, milk yield and quality of milking cows under Vietnam weather condition from November 2022 to January 2023 at the dairy farm of ANOVA Binh Duong. The study was conducted using a total of 94 Holstein Friesian (HF) crossbred cows with at least 3/4 HF blood, with days in milk (DIM) at days, and lasted 30 days (the first 15 days for the control without SCP supplementation (control) and the next 15 days for the SCP treatment with SCP addition at 5 g/cow per day (SCP). Results showed that the average feed intake (as fed) of cows in the control period was significantly lower than that of cows in the SCP period ($P < 0.01$). The SCP supplementation did not affect ($P > 0.05$) the milk productivity and milk fat, while milk protein, lactose, and solids not fat (SNF) from the milk of cows in the SCP group were significantly improved ($P < 0.01$). The SCP supplementation also significantly enhanced ($P < 0.05$) the body condition score (BCS) of dairy cows. Briefly, these results suggest that the dietary SCP addition of 5 g/cow per day seems to significantly improve the feed intake, BCS and milk quality parameters of lactating cows.

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1. Introduction

The dairy industry provides significant nutritional and economic benefits to humans and society, contributing significantly to the development of global agriculture. In developing countries, dairy production systems are affected by many factors including genetics, nutrition, infectious, parasitic diseases, or heat stress caused by high temperature and humidity (Das et al., 2016; Gauly & Ammer, 2020; Nguyen et al., 2021). Dairy production in Vietnam has experienced significant growth and development over the past decade. Currently, the milk consumption in Vietnam is still low at 27 liters/head per year (35 liters/head per year and 45 liters/head per year in Thailand and Singapore in 2021, respectively) and there will be a strong increase in demand for humans in milk consumption to reach about 40 liters/head per year by 2030 (equivalent to the growth rate of about 4% annually) (Nhat, 2023). The development of the dairy system in Vietnam requires the enhancement of knowledge and skills of farmers related to the general husbandry including genetics, nutrition, and heat stress management (Nguyen et al., 2022). Nutritional factors signigicantly affect milk yield and compositions in addition to breed selection as a primary step to improve milk productivity and feed efficiency (Hristov et al., 2004; Lee et al., 2014; Olika, 2021). Therefore, nutrient balance in daily diets plays a significant role in dairy production.

In recent years, there has been a lot of interest in using products containing yeast, *Saccharomyces cerevisiae*, as potential supplements (Majdoub-Mathlouthi et al., 2009; Julien et al., 2018; Oh et al., 2019). In fact, it is shown that there are widely used these products in diets for high-yielding dairy cows. *Saccharomyces cerevisiae* is known as a probiotic, which can positively influence the gut health and metabolic processes of dairy cows. It has been shown to improve feed efficiency, increase milk yield, and improve milk quality by modulating rumen fermentation and promoting beneficial microbes (Chaucheyras-Durand et al., 2008; Desnoyers et al., 2009). In Vietnam, however, the practical benefits of a *Saccharomyces cerevisiae*-contained product in dairy production at local climate conditions are still limited and this study is needed to clarify this point.

Therefore, the objective of the current study was to determine the effects of one product that contained the *Saccharomyces cerevisiae* on feed consumption, milk yield, and quality of lactating cows under Vietnam weather conditions.

2. Materials and Methods

2.1. Location

The study was conducted at the dairy farm of ANOVA Binh Duong from November 2022 to January 2023.

2.2. Experimental design, animals, and housing

The study was arranged into a randomized complete design with two treatments of rations, including (1) control with cows fed the current farm-based ration and (2) Saccharomyces cerevisiae-contained product (SCP) with cows fed the control-like diet supplemented at 5 g/cow per day of a *Saccharomyces cerevisiae*-contained product (Biotic-Cattle at 10^{10} *Saccharomyces cerevisiae* per g of product, SCP) (Table 1). Based on the practical conditions of the farm, the study was designed as one-group trial of cows before (control) and after (SCP treatment) the SCP addition into the daily diets of lactating cows. Cows were housed in the same cubicle shed

containing rubber mats with continual access to water (*ad libitum*). The study was conducted on a total of 94 Holstein Friesian (HF) crossbred cows with at least 3/4 HF blood, with days in milk (DIM) from 31 to 128 days (73.5 ± 25.9 days) and lasted 30 days (the first 15 days for the control treatment without SCP supplementation and the next 15 days for the SCP treatment with SCP addition) (Table 1).

Table 1. Experimental design

Treatment	Control (No dietary SCP addition)	SCP (Dietary SCP addition)
Cows (n)	94	94
Trial period	The first 15 days	The next 15 days
Daily SCP addition (g/cow per day)	0	5

SCP: Saccharomyces cerevisiae-contained product.

2.3. Daily ration of cows

All cows were fed twice a day (7:30 and 14:00, *ad libitum*) as total mixed ration method (TMR) as the current farm-based ration, including king grass (28 kg/cow per day), alfalfa hay (2 kg/cow per day), rice straw (0.5 kg/cow per day), corn silage (4 kg/cow per day) complete feed (6 kg/cow per day), molasses (0.5 kg/cow per day), brewers grain (4 kg/cow per day), and other feed additives. The *Saccharomyces cerevisiae*-contained product (SCP) was mixed with new corn powder and mixed well with TMR for the SCP treatment after the trial period of the control. The TMR feed was available at all positions of the feeding trough for the same consumption per cow.

2.4. Sample collection and measurements

Milk yield (kg/cow per day): All cows were milked by milking system into specialized container two times a day (5:30 and 15:00), using the recording machine in the milking system, and then merging two times into the average milk yield.

Milk quality: About 50 mL of milk was taken in the morning milking time to determine concentrations of milk fat, protein, solids not fat (SNF) and lactose, stored between 2 - 6°C condition and transported quickly to an analytical laboratory. Milk quality was analyzed by Ekomilk M machine (BULTEH 2000, Bulgaria) about 60 sec/sample for the testing result. Before putting the sample into the machine for analysis, the sample must be shaken well and pour about 10 mL of milk sample into the cup then press OK and wait for the machine to measure for 90 sec.

Feed intake as fed (kg/cow per day): The total amount of feed for each treatment was recorded before feeding and refusal feed was collected in the early morning for calculation of the feed consumption as fed per day.

Temperature-humidity index (THI): Use a specialized barn microclimate meter to measure temperature and humidity at a height of 1.5m from the house floor. Then, apply the equation to calculate the THI = T (°F) - 0,55 * (100 - RH%)/100 * (T - 58) (Ingraham et al., 1974; Nguyen et al., 2018).

Body condition score (BCS): Individual cow was evaluated for BCS ranging from 1 to 5 according to the official method described by Wildman et al. (1982) and Nguyen et al. (2022) on the days of 15 and 30 of the experimental periods.

2.5. Statistical analysis

Data were analyzed a Paired t-test using the Minitab Software 16.2. The percentages were compared with the χ2 test. The differences were considered significant at $P < 0.05$.

3. Results and Discussion

3.1. Feed intake

Table 2. Effect of dietary SCP supplementation on feed consumption

Parameters	Replication	Control	SCP	*P*
Average THI	15 days	81.5 ± 0.9	81.3 ± 1.6	> 0.05
Average feed intake (kg/cow per day as fed)	94 cows	36.2^{b} ± 1.3	40.3^{a} ± 1.5	< 0.01

[ab]Means in the same row without common letters are different at P < 0.01; SCP: Saccharomyces cerevisiae-contained product; THI: Temperature-humidity index.

The average THI in control within trial period of cows fed the current farm-based ration without SCP addition was 81.5 and not different from that of SCP within the trial period of cows fed diet supplemented SCP product at 81.3 ($P > 0.05$; Table 2). However, the average feed intake (as fed) of cows fed the current farm-based ration was 36.2 kg/cow per day and was significantly lower than that of cows fed diet supplemented SCP product of 40.3 kg/cow per day ($P < 0.01$). Chaucheyras-Durand et al. (2008) reported that the yeast product, *Saccharomyces cerevisiae*, contains some potential factors that stimulate the growth of rumen microorganisms, especially for lactate-utilizing species. A stable and well-developed rumen microflora will help cows increase their feed intake (Olagaray et al., 2019). In the rumen, SCP stimulates cellulolytic bacteria to break down complex fibers in the cow's diet, thus making improvements in fiber digestion, feed consumption and metabolism efficiency (Desnoyers et al., 2009).

3.2. Milk yield and quality

The average milk yield of the control was 31.72 kg/cow per day and not different from that of the SCP of 31.21 kg/cow per day ($P > 0.05$; Figure 1). The results in the current study showed that SCP supplementation into the daily diets for dairy cows did not affect the milk productivity, which is suitable with the previous findings of no difference in milk yield between cow groups with and without supplementation of *Saccharomyces cerevisiae* fermentation product (Olagaray et al., 2019). It is possible that the addition level (5 g/cow per day) in this study is not enough to improve the milk yield and milk yield is greatly affected by many potential factors besides nutrition, such as housing, heat stress, disease, etc.

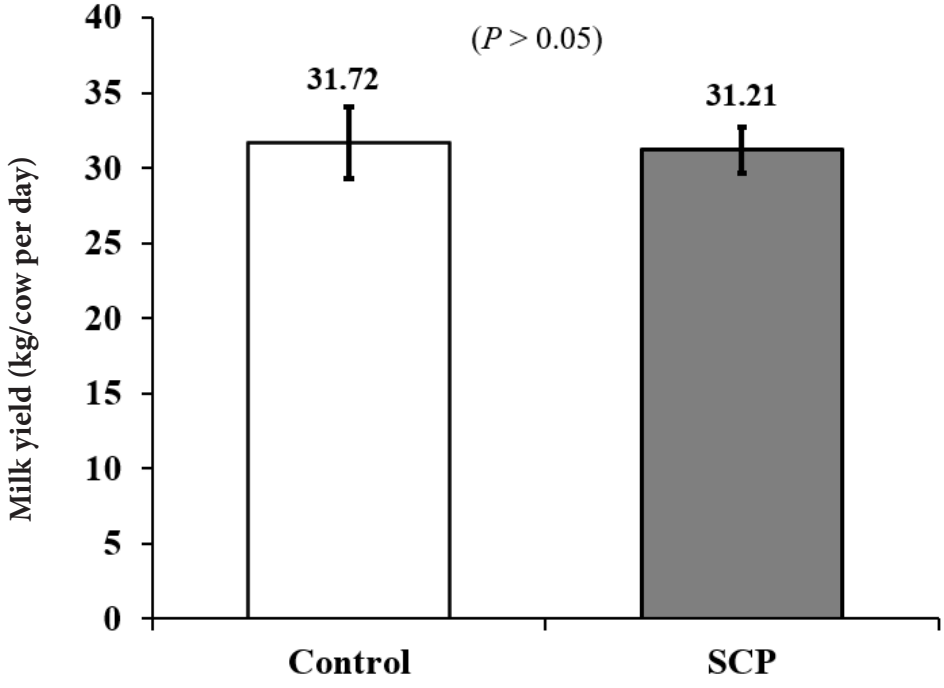

Figure 1. Effect of SCP addition on milk yield during experiment (n = 94 cows). SCP: *Saccharomyces cerevisiae*-contained product.

Table 3. Effect of dietary SCP supplementation on milk quality parameters (n = 94 cows)

Milk quality	Control	SCP	*P*
Milk fat (%)	3.90 ± 0.57	3.68 ± 0.30	0.327
Milk protein (%)	3.02^{b} ± 0.08	3.10^{a} ± 0.04	< 0.01
Milk lactose (%)	4.39^{b} ± 0.14	4.51^{a} ± 0.07	< 0.01
SNF (%)	8.00^{b} ± 0.24	8.23^{a} ± 0.10	< 0.01

^{ab}Means in the same row without common letters are different at P < 0.01; SCP: Saccharomyces cerevisiae-contained product; SNF: solids not fat.

The average milk protein, lactose and SNF from the milk of cows in the SCP group (3.10, 4.51 and 8.23, respectively) were significantly higher than those of cows in the control group (3.02, 4.39 and 8.00, respectively) ($P < 0.01$; Table 3), while there was no significant difference in the average milk fat between the two groups ($P > 0.05$). It has been reported that *Saccharomyces cerevisiae* enhances the efficiency of nutrient utilization in dairy cows by stabilizing ruminal pH and promoting beneficial microbes (Chaucheyras-Durand et al., 2008; Desnoyers et al., 2009). Therefore, this improvement in nutrient absorption often results in better milk composition, especially higher levels of milk protein and SNF, without increasing the overall milk productivity (Desnoyers et al., 2009). Meanwhile, Olagaray et al. (2019) mentioned that milk fat content increased by about 13% in the milk of cows supplemented with *Saccharomyces cerevisiae*.

3.3. Body condition score (BCS)

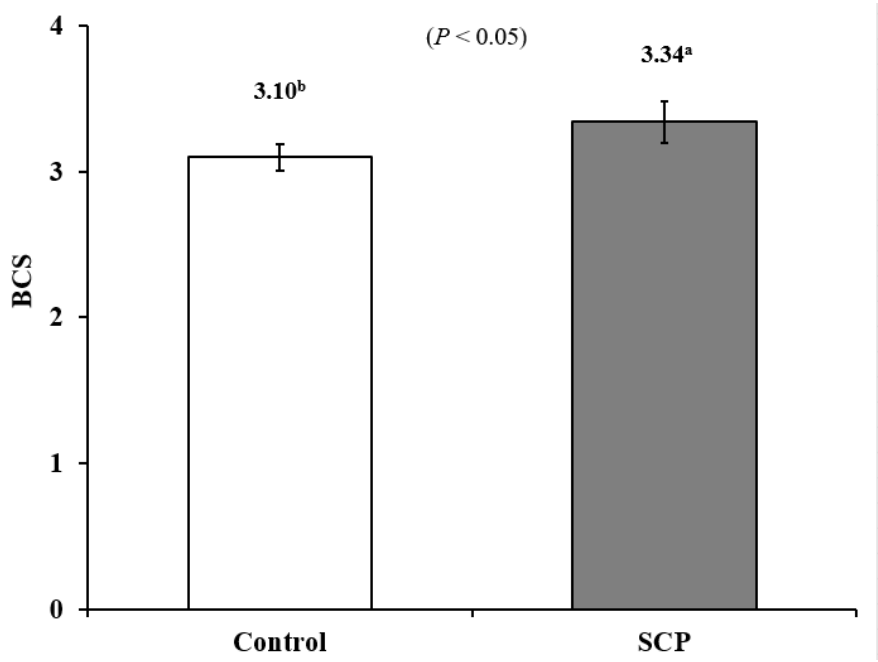

Figure 2. Effect of dietary SCP supplementation on BCS (n = 94 cows). BCS: The body condition score; SCP: *Saccharomyces cerevisiae*-contained product.

The average BCS in the control within the trial period of cows fed without SCP addition was 3.10 and significantly different from that of SCP within the trial period of cows fed with SCP product supplementation at 3.34 ($P < 0.05$; Figure 2). BCS in the trial period with SCP were higher than in the pre-trial period without SCP possibly due to increased feed intake. It has been demonstrated that *Saccharomyces cerevisiae* supplementation can stimulate appetite and increase dry matter intake, thus better supply of the energy and nutrient as animal's requirements, leading to the improved BCS (Poppy et al., 2012).

4. Conclusions

The results of the current study suggest that dietary SCP supplementation in daily diets increased feed intake and improved BSC and milk composition (solids not fat, protein and lactose) of dairy cows as compared to daily diets without SCP.

Conflict of interest

The authors declare no conflict of interest.

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