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**Original Research Article**

# Effect of Treating Date Peels with Different Levels of Yeast (*Saccharomyces cerevisiae*) on Some Fermentations of Rumen Fluid in Vitro

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**Abstract:** ***Introduction*:** The high cost and limited availability of traditional feeds at certain times of the year is one of the biggest constraints to animal production. This study aimed to demonstrate the effect of using dried date peels, and baker's yeast (*Saccharomyces cerevisiae*, S.s) in different incubation periods on rumen fermentations. Three levels of dried date peels (15%, 30%, and 60%), with different baker's yeast **(***Saccharomyces cerevisiae*, S.C.) are used in this study in vitro condition. ***Results*:** The different treatments used in this study had a significant increase in ruminant gas production. ***Conclusion*:** Baker's yeast **(***Saccharomyces cerevisiae*, S.C.) and date peels do not affect reducing rumen gas, indeed, these treatments increase the gas produced by the feed in vitro conditions.

**Keywords:** *Saccharomyces cerevisiae*, date peels, rumen fermentation.



## INTRODUCTION

The biggest obstacles in animal production include the high cost of traditional feed and low availability at certain times of the year. On this basis, is now turns to finding alternatives by using industrial and agricultural wastes (date petals, fresh and dried kernels, palm leaves, buckwheat and rice husks and their embryos) as feedstuffs as non-traditional roughage that can be used to feed ruminants, after physical or chemical treatment, Abo Omar, 2017.

Found that the in vitro digestibility coefficients of neutral and acid detergent fibers (NDF and ADF) increased significantly when goats were fed palm residues EL-Hag and EL-Khangari (1992). this result is consistent with (Elhag *et al.*, 1993) when a scale of 25 is used. Excluding 35% of the data resulted in a significant increase in the digestibility coefficient. Al-Ghazali (2009) stated that no significant differences were found when feeding Awassi lambs treated with 34% date peels containing probiotics. Ahmed *et al.*, (2014) stated that their research results showed that the proportion of replacing barley with 0, 10, and 20 whole dates and crud added dates had no significant difference in the digestibility coefficients of dry matter, and crude protein, while organic matter and the difference in crude protein was significant ($P < 0.01$). In terms of overlap in dates and physical form, there was a significant difference in crude protein digestibility (Abbes, 2013).

Yeast cultures provide growth-promoting substrates to ruminal bacteria, such as B vitamins, organic acids, amino acids, and, peptides (Newbold and Rode, 2006). Fermentation, particularly in yeast utilizing sugar, yields a diverse range of metabolites such as peptides, alcohols, organic acids, and esters, which may have beneficial effects on animal health and nutrition (Shurson, 2018). A meta-analysis investigating the effects of supplementation with Saccharomyces cerevisiae on milk production and rumen fermentation parameters concluded that dietary yeast promotes increased dry matter intake (DMI), total milk production, pH rumen, total VFAs concentrations, and OM digestibility (Desnoyers *et al.*, 2009). The outcome was similar to the one achieved by Poppy *et al.*, meta-analysis, which was later published by the same team. Using yeast culture supplementation and supplementation with Saccharomyces cerevisiae, A 2012 study revealed that providing supplements improved the performance of lactating dairy cattle,

resulting in increased dry matter intake as well as higher yields of total milk and milk components. According to Chaucheyras-Durand *et al.,* (2012), there was an increase in milk production and easier fermentation due to the stimulation of rumen bacteria that break down cellulose and utilize lactate. However, it is important to mention that the impact of yeast inclusion on rumen protozoa numbers remains unclear and not fully understood. The presence of dietary yeast has resulted in a rise in protozoal numbers (Kowalik *et al.,* 2012; Chaucheyras-Durand *et al.,* 2019). Bacteria make up 98% of all cells found in the rumen and have a major impact on breaking down feed in the rumen (Lin *et al.,* 1997). Cellulases enzymes are produced by cellulolytic bacteria, and their abundance increases in response to a high-fiber diet, aiding in the fermentation of cellulose (Mosoni *et al.,* 2007). Cellulolytic bacteria in the rumen are anaerobes that can be harmed by the presence of oxygen and their numbers are reduced by low ruminal pH, which in turn affects fiber digestibility (Chaucheyras-Durand *et al.,* 2012). Certain scientists have discovered that adding Saccharomyces cerevisiae (S.c.) can improve how ruminants digest feed by boosting nutrient digestibility, maximizing ruminal volatile fatty acid (VFA) levels, reducing ammonia nitrogen (NH3-N), stabilizing pH levels, and increasing the number of ruminal microorganisms.

Establish: to the effect of using different levels of date peels (15, 30, 60%) with fermentation by different levels of baking yeast (S.c.) (1, 2& 3%) on some in vitro fermentations of rumen fluid and for different incubation periods.

## MATERIALS AND METHODS

The experiment was conducted in the Nutrition In vitro to study the effect of using increasing percentages of dried dates peels with treatment of different percentages from yeast (Saccharomyces cerevisia) S.c. 0,1,2 and 3 % of dry matter to their mixture In vitro. The table 1, 2 & 3 indicate of experimental ration.

T1= 15% date peels +1% (S.c.) T4= 30% date peels +1% (S.c.)

T2= 15% date peels +2% (S.c.) T5= 30% date peels +2% (S.c.)

T3= 15% date peels +3% (S.c.) T6 = 30% date peels +3% (S.c.)

T7= 60% date peels +1% (S.c.) T8= 60% date peels +2% (S.c.)

T9= 60% date peels +3% (S.c.)

**1-Digestibility of the Organic Matter and the Dry Matter (%)**

The digestibility of dry matter and organic matter was calculated following the procedure outlined by Tilley & Terry (1963), involving transferring 0.5 gm to digestion tubes along with 10 ml of rumen fluid and 40 ml of saliva. Anaerobic conditions were maintained by supplementing with Carbon dioxide gas twice a day. The tubes were immersed in a water bath kept at 39º C for 48 hours, being agitated twice daily. Next, the samples undergo filtration. The products from both microbial digestion and enzyme stages are dried at 105 °C for 24 hours to determine the dry matter digestibility percentage. Afterwards, the samples are incinerated at 550-600 °C for 3 hours to analyze the percentage of ash and perform chemical analysis.

**2-Determination of Gas Production**

The total gas and methane gas production in the in vitro was estimated according to the method of Menke & Steingass (1988), adding 0.2 g was taken of the ration and move to a 100 ml glass syringe with the transport of 10 ml of Rumen fluid filtered from a ram, then 20 ml of artificial saliva prepared at the time. All injections were placed at temperature of 39ºC, for 24 hours. 4 Replicates were taken for each sample and 4 blank. Then the designated injections were withdrawn after the final of the incubation period to calculate the total gas production, then 4 ml of 4% sodium hydroxide was added to 2 of the samples that had not been divided to calculate methane gas production according to the method Fievez *et al.,* (2005).

**3- Study Characteristics of Rumen Fluid**

The concentration of ammonia nitrogen (NH3-N) in the rumen, measured in mg/100ml, was determined using the method outlined in the A.O.A.C. 2005. This involved taking approximately 10 ml of rumen fluid after a specific period of incubation and transferring it to each of the 50 ml tubes. The total volatile fatty acids (VFAs) concentration was assessed following the method outlined by Warner in 1964.

**Statistical Analysis**: The data were analyzed in a 2 × 3 factorial experiment design by using of SAS (2012) and Duncan's (1955).

**Table 1: Chemical composition of feedstuff**

| Matter | Soybean meal | Barley | Date peels | Wheat bran |
|---|---|---|---|---|
| DM | 90.10 | 91.00 | 91.00 | 90.10 |
| CP | 46.0 | 10.75 | 6.20 | 14.00 |
| EE | 2.00 | 1.45 | 1.01 | 4.00 |
| CF | 5.81 | 6.65 | 24.40 | 14.50 |
| NFE | 30.0 | 68.13 | 53.85 | 5 |
| Ash | 6.30 | 4.02 | 5.54 | 6.00 |

**Table 2: Components of experimental ration**

| Feedstuff | Ration | | |
|---|---|---|---|
| | 15% Date peels | 30% Date peels | 60% Date peels |
| Date peels | 15 | 30 | 60 |
| Barley | 45 | 30 | 0 |
| Soybean meal | 9 | 10 | 13 |
| Wheat bran | 29 | 28 | 25 |
| Salt (NaCl) | 1 | 1 | 1 |
| Limestone | 1 | 1 | 1 |
| **Total** | **100** | **100** | **100** |

**Table 3: Chemical composition of experimental ration**

| Components | Ration | | |
|---|---|---|---|
| | 15% Date peels | 30% Date peels | 60% Date peels |
| DM | 89.80 | 90.02 | 89.50 |
| CP | 13.96 | 13.60 | 13.20 |
| EE | 2.12 | 2.05 | 1.92 |
| CF | 11.29 | 13.95 | 17.28 |
| NFE | 57.48 | 55.25 | 53.39 |
| Ash | 4.95 | 5.17 | 5.63 |

## RESULTS AND DISCUSSION

### 1. Digestion coefficient

The results show significant increased ($p \leq 0.05$) of digestion coefficient (DC) of dry and organic matter has recorded in T4 (30% of date peels with 1%of (S.c.) on other study treatments (table 4), the *Saccharomyces cerevisiae*, (S.c.) has provided an essential requirements for growing ruminant microorganisms and increased the D. C., and the date peels have necessary fatty acids for rumen bacteria (Poppy *et al.,* 2012). this result was in agreement with AL-Owaimer *et al.,* (2011) which demonstrates that the using of date peels has important role in increasing of digestion coefficient.

**Table 4: Digestion coefficient of dry matter, and organic matter after an incubation period of 48 hour**

| Treatment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | significant |
|---|---|---|---|---|---|---|---|---|---|---|
| Date peels% | 15% | | | 30% | | | 60% | | | |
| s.c.% | 1% | 2% | 3% | 1% | 2% | 3% | 1% | 2% | 3% | |
| DDM | 69.50±3.00 cd | 70.28±2.31 c | 73.76±1.32 ab | 75.21±3.28a | 71.88±3.20 c | 71.00±2.40 c | 71.02±2.09 c | 73.04±1.03 ab | 70.27±2.92 c | * |
| DOM | 73.91±2.45 c | 73.98±2.90 c | 76.32±2.90 b | 77.38±2.15a | 76.01±3.07 ab | 74.81±2.08 bc | 74.29±3.27 bc | 76.37±2.00 ab | 73.60±1.94 c | * |

Various letters on the line indicate important distinctions, NS = no significant distinctions, within the same column * there is a significant distinction at the 0.05 level ** there is a significant distinction at the 0.01 level T1= 15% date peels +1% (s.c.) T2= 15% date skins +2% (s.c.) T3 consists of 15% date peels and an additional 3% (s.c.). 30% of the mixture consists of date peels, with an additional 1% of a secondary component. T5= 30% date peels +2% (s.c.)

### 2. Methane and Total Rumen Gas Production:

The results of Table (5) show a significant increase ($p \leq 0.05$) in total production (ml/200 mg D. M.) to T4 on other study treatments, also T4 recorded a higher methane gas production in comparison with other study treatments. As it shows by figure 1 Production of total gas and methane gas.

This may be due to the high crude fiber content, which provided an ideal condition for methane gas production, The results were in agreements with Boufennara *et al.,* (2016) which study the effect of using date residues (palm fronds, date pits, date pith or oat meal) on total gas production 324 ml/g dry matter compared to 105 ml for fronds and 70 ml for pits as

well as oat meal on rumen fermentation and gas production for different incubation periods.

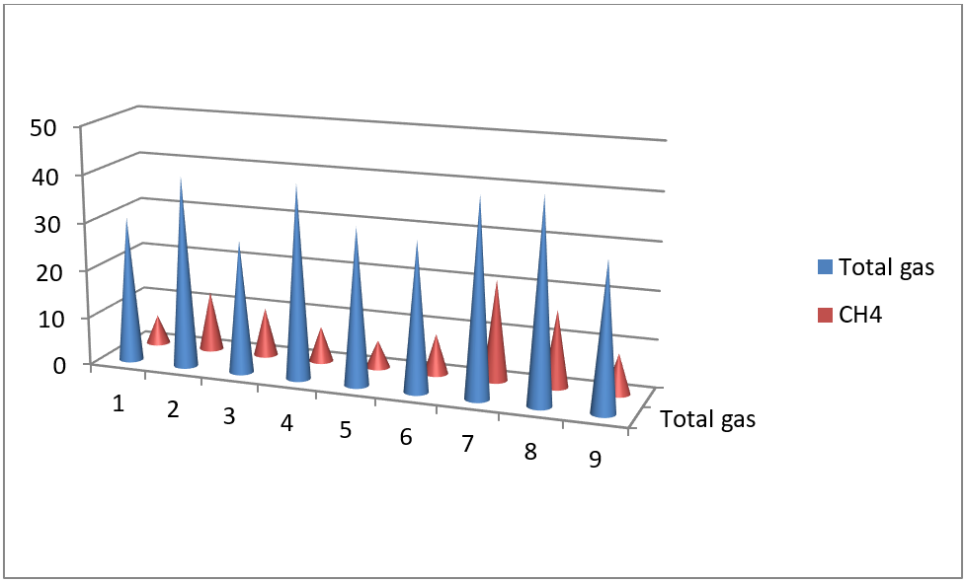


**Figure 1: Production of total gas and methane gas ml/200 mg dry matter**

**Table 5: Total gas and methane production (ml/200 mg dry matter)**

| **Treatment** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **significant** |
|---|---|---|---|---|---|---|---|---|---|---|
| Date peels | 15% | | | 30% | | | 60% | | | |
| s.c. | 1% | 2% | 3% | 1% | 2% | 3% | 1% | 2% | 3% | |
| Total gas 6H | 12.66±0.66bcd | 13.33±1.45 bc | 8.66±0.66cde | 9.33±1.20cd | 15.33±2.41 ab | 12.01±1.21 de | 14.43±0.89 abc | 14.56±1.22 abc | 16.43±1.55 a | ** |
| Total gas 12H | 22.33±1.20 ab | 20.00±1.45b | 14.33±0.66 d | 13.00±0.57d | 24.34±1.21 a | 19.67±0.89 c | 21.65±1.22 b | 20.64±1.4 b | 22.32±0.98ab | ** |
| Total gas 24H | 40.66±0.33 ab | 28.00±0.57 e | 30.33±0.88 fe | 27.66±1.76 e | 40.34±2.23 ab | 32.65±0.67 de | 41.00±0.43 ab | 42.02±1.11 a | 30.45±0.43 fe | ** |
| CH4 | 10.66±0.33 dce | 7.66±1.20 ef | 6.00±0.57 efg | 10.01±0.54 dfc | 7.34±0.31 ef | 5.56±0.43 g | 21.03±0.53 a | 16.02±0.65 b | 8.43±0.54 dfe | ** |

Variations in letters in the row indicate significant differences, with NS indicating no significant differences in the same column, * representing significance at the 0.05 level, and ** representing significance at the 0.01 level. T1= 15% date peels +1% (s.c.) T2= 15% date peels +2% (stem cells) T3= 15% dried date peels +3% (standard condition). 30% of the mixture is composed of date peels and an additional 1% is included (w/w). T5= 30% date peelings +2% (s.c.) T6 consists of 30% date peels and an additional 3% (s.c.). T7= 60% date peel mixture with an additional 1% (s.c.) T8 consists of 60% date peels and 2% (solid content), while T9 contains 60% date peels and 3% (solid content).

**3. Rumen Fermentation (pH, Ammonia Nitrogen, Total Volatile Fatty Acids) and Bacterial Count:**

The results of table (6) show that T8 has a significant increase ($p \leq 0.05$) in $NH_3$ (mean±SD 23.53±0.76) on all other treatments. T6 has a significant increased ($p \leq 0.05$) in TVFAs (mmol/100ml) on other treatments.

For the total bacteria count the results showed a significant increase ($P \leq 0.01$) in T6 on other study treatments, due to the synergistic effect between the nutritional compounds provided by date peels and *Saccharomyces cerevisiae* create an ideal condition for the growth and reproduction of rumen bacteria strains, which positively influenced the fermentations and other study parameters, this result was in agreement with Hamza *et al.*, (2021) they concluded that the volatile fatty acid concentration of 4.27 mmol/L in date Bouarus residues was higher than other residues, by promoting microbial growth in rumen fluid.

**Table 6: Rumen Fermentations (pH, Ammonia Nitrogen, Total Volatile Fatty Acids) and Bacterial Count**

| **Treatment** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **Significant** |
|---|---|---|---|---|---|---|---|---|---|---|
| Date peels% | 15% | | | 30% | | | 60% | | | |
| S.c.% | 1% | 2% | 3% | 1% | 2% | 3% | 1% | 2% | 3% | |
| pH Value | 6.56±0.08 | 6.51±0.06 | 6.43±0.54 | 6.53±0.03 | 6.46±0.09 | 6.40±0.07 | 6.26±0.66 | 6.20±0.54 | 6.36±0.4 | N.S. |
| Ammonia Conce. N (mg/100ml) | 16.77±0.14cd | 15.50±0.28d | 18.02±0.11bc | 18.01±0.12 bc | 17.50±0.27 c | 18.75±0.83bc | 21.92±0.12 ab | 23.50±0.76 a | 19.75±0.23 b | ** |
| Total of VFA(mmol/100ml | 4.73±0.75 b | 4.52±0.54cd | 4.34±0.88 c | 4.63±10.45bc | 4.60±0.52bc | 4.83±0.20 a | 4.76±1.15 ab | 4.46±0.03 cd | 4.46±0.74cd | ** |
| Total bacteria CFU $X^7$ | 12.32±0.89 cd | 7.65±1.02 fg | 5.01±0.54 h | 7.31±032 fg | 8.65±0.31 ef | 15.66±0.01 a | 13.00±0.57 b | 10.33±0.32 de | 12.55±0.57 c | ** |

Different letters, within the line mean the presence. of significant .differences, NS = no significant differences within .the same column * there is a significant ,difference at the level (0.05) ** there is a significant, difference at the level (0.01 ) T1= 15% date peels +1% (s.c.) T2= 15% date peels +2% (s.c.) T3= 15% date peels +3% (s.c.) T4= 30% date peels +1% (s.c.) T5= 30% date peels +2% (s.c.) T6 = 30% date peels +3% (s.c.) T7= 60% date peels +1% (s.c.) T8= 60% date peels +2% (s.c.),T9= 60% date peels +3% (s.c.)

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