# THE EFFECTS OF OLIVE POMACE ON THE FATTY ACID PROFILE AND WEIGHT GAIN IN *CAPRA AEGAGRUS HIRCUS* AS A MODEL FOR RUMINANTS

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by

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THE EFFECTS OF OLIVE POMACE ON THE FATTY ACID PROFILE AND WEIGHT GAIN IN *CAPRA AEGAGRUS HIRCUS* AS A MODEL FOR RUMINANTS

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## ABSTRACT

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In the livestock industry, feed is one of the highest variables affecting the cost of production. Olive pomace is a by-product of the olive oil industry and could be considered as a potential livestock feedstuff to be used as an energy supplement due to its high fat content (15%) and can potentially alter the biochemical composition of blood and muscle tissue. This project was split into two phases; the objective of phase I was to determine if olive pomace could be used as an acceptable low cost feedstuff to maintain weight during the colder winter months. To accomplish this, 28 Spanish influenced goats were fed (2% of body weight, BW) varying amounts of fermented pomace with a protein pellet to meet NEm requirements. The four test groups (n=7) consisted of a 3:1, 1:1, and 1:3 olive pomace to concentrate ratio (O:C) as well as a control containing no pomace. All groups received molasses at 0.5% BW to improve the palatability of the feed and to further homogenize the ration to discourage selective eating of the mixture. Does were fed in herring bone style runs every morning for 49 days. The average daily gain (ADG) for the 1:3, 1:1, 3:1 and control groups were 0.0370, 0.0166, 0.0119, and 0.0262 kg/day, respectively with no difference detected between groups ($P$>0.88). A difference ($P$<0.001) in consumption rates was detected between treatments with the 3:1 group consuming more feed with an average of 0.785 kg/day compared to the control at 0.694 kg/day. Additionally, olive pomace may be consider as a cost effective supplement to reduce costs for maintenance rations. Ration costs were calculated at $0.153/kg for the 3:1 ration compared to $0.6386/kg for the pelleted control ration. On average, this

difference in input cost can reduce a producer's cost of feed by $13.53/hd over a 49 day maintenance feeding period ($P$<0.001) by feeding olive pomace. The objective of phase 2 was to determine if olive pomace could be supplemented at a level that increases the C18:1 concentration in blood. Mature Spanish-influence goats (n=14; 41.6 kg) were fed *ad libitum* olive pomace, starting at 2% of their BW for 28 days to determine if this by-product would alter circulating fatty acid content. Molasses was mixed with the ration at 0.5% BW to improve the palatability of the feed. Does were fed in herringbone-style runs every afternoon and BW and blood samples were collected every two weeks. There were significant changes in C18:1 and C18:2 over time with mean consumption of 0.55 kg/d over the duration of the trial. From d 0 to d 28, the serum concentration of C18:1 increased ($P$<0.001) by 8.67% and C18:2 increased (P<0.03) by an average of 4.38%. Serum concentration of C18:0 increased by 3.59% but this was not significant. There was also no significant increase in C16:0. If C18:1 is deposited in the muscle tissue as a result of increased concentration in the blood, then feeding olive pomace can be a healthy alternative to high starch ingredients such as corn and barley.

KEYWORDS: Olive, Goats, ADG, Palatability, Oleic, Serum

**ACKNOWLEDGEMENTS**

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# CHAPTER I

## Introduction

Livestock used in food production require certain nutrients from feedstuffs for body functions and growth. Producers supplement domestic animals in order to accelerate their natural growth curve, thus making a more plentiful and profitable harvest in order to feed our ever-growing population. Ruminants are incredibly efficient at digesting forages due to the vast population of micro-flora, bacteria, and other small organisms that reside in their gastrointestinal tract. This project focused on how these microbes affected the fatty acid (FA) profiles in a number of different polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) in olive pomace, and secondly, defining the feed efficiency and performance of the pomace in a commercial setting was assessed.

Olive pomace is the by-product of processing olives through a hammer mill. This by-product is one of the few items created from the production of olive oil and has no predetermined or widely known purpose and is commonly discarded as waste by olive producers. This study examined the effects of this by-product to help olive producers find a long term and profitable supplement to reduce feed costs. The pomace consisted of up to 80 percent oleic acid (C18:1 cis-9), along with linoleic acid (C18:2), and palmitic acid (C16:0) (Ranali et al., 2002). Small traces of stearic acid (C18:0) and α-linolenic acid (C18:3 cis-9,12,15) can also be found in the pomace and olive residue (Ranalli et al., 2002). Due to the price of feedstuffs high in these types of fats, the feeding of these materials is not widely practiced throughout the commercial feeding industry. It is more economical to feed concentrates that are much higher in carbohydrates, yet fats have a higher energy level and can therefore be fed in lower quantities to achieve the same endpoint when compared to the carbohydrate based concentrates. By analyzing the effects of olive pomace, producers may be able to utilize this by-product as a high-energy feedstuff with minimal costs.

## Review of Literature

### Feeding Industry Relevance

The food animal industry has the burden of producing enough livestock to provide meat at adequate levels to feed the growing population. The USDA recorded in 2014 that there are 13.1 million head of cattle on feed as of January 2015 in the United States (United States Department of Agriculture, 2016).

Previous research has documented livestock fattened on pasture are likely to increase the incidence of omega-3 FAs in the tissue (Wood et al., 2004). Bessa et al. (2005) however, noted an instance that intake increased yet carcass weight decreased when Merino Branco ram lambs were left to pasture when only lucerne was provided. The groups in their experiment that were supplemented with soybean oil along with lucerne pellets showed the opposite results. They also noticed that oil supplemented ram lambs increased in *trans*-octadeceonates and conjugated octadecadienoates isomers while having a lower ratio of n-6/n-3 fatty acids (Bessa et al., 2005).

### Fatty Acid Composition

Specifically concerning goats, the fatty acid profile can change dramatically depending on age, intake type, and other variables as determined by Banskalieva, Sahlu, and Goetsch (2000). The effects of oleic acid ((9*E*)-Octadec-9-enoic acid or 18:1 cis-9) are of particular interest. It is known that the health benefits of olive oil are in fact correlated with the high oleic acid content (Terés et al., 2008). As the oleic acid intake increases, it becomes a regulator of membrane lipid structure in such a way as to control protein-mediated signaling, causing a reduction in blood pressure (Terés et al., 2008).

Scollan et al. (2001) stated that it is possible to introduce various feedstuffs with desired fatty acid chains and raise their presence in the tissue of beef cattle. Over 120 d, Scollan et al. (2001) found that only a select few fatty acids could be directly influenced by feeding excessive levels. Of these, α-linolenic, docosapentaenoic, and docosahexaenoic are the main ones addressed. Oleic acid however, remained at a level comparable to day 0 in the control and decreased in each test group. This can be partially explained by the fact that their feedstuffs, linseed and fish oil, were not high enough in oleic acid to sustain the oil in tissues. It is also noted that the study conducted by Velasco et al. (2004) found similar results to the former. A key difference in these studies was unweaned lambs left to pasture exhibited lower levels of stearic (C18:0) and oleic fatty acids. However, the level of fatty acids containing less than 18 carbons all increased. This study further investigated the deposition of oleic acid in muscle tissues as seen with these trials. However, animals were supplemented with a feedstuff that is high in C18:1 cis-9 in attempts to increase the fatty acid profile in muscle tissue.

**Olive Industry Relevance and Production of Pomace**

The olive industry in California is producing approximately 900,000 gallons of olive oil per year as of 2010 (American Olive Oil Producers Association, 2016). Texas, however is on the path to becoming a major producer of olive oil. Operations have been on the rise and have upwards of 11,000 trees producing each year. The milling process is short when compared to the time it takes to produce a fruit-bearing tree. Once the olive is picked or hits the ground due to its ripeness, it must be sent for processing within a matter of hours due to the quick deterioration of the fruit after full ripening. The olives are then cleaned and placed into a hopper leading into a hammer mill, which begins the breakdown of the fruit (Ranalli and Angerosa, 1996). After a considerable amount of time in a centrifuge and hydration, the olive oil is separated from the pomace, which mainly consists of pits, skins, and water. The pomace, which is the item of subject for this study, is a tannish material with a consistency much like a paste. There is a slight amount of oil and water in the pomace, which will only add to the nutrients found in the feedstuff when utilized as such. It is not widely known what the nutrient profile of the pomace is, because olive producers currently have no need to analyze the pomace. Most producers in Texas apply the pomace to the soil surrounding the olive trees or turn it into compost, while some select producers feed the pomace to livestock. Even though the taste is quite bitter and bland, cattle find the pomace quite palatable at various Texas olive operations.

**Mediums of Feeding the Pomace**

The pomace is perishable, so the method in which it is fed and the economic feasibility are a topic of concern. There are similar by-products of grain industries that are fed in various ways. Corn stalks, for example, are turned into silage by fermentation processes. After researching types of extra processed feedstuffs, three possible methods to feeding the pomace were considered.

- Feeding as Fed, or Wet – Feeding the pomace without any further processing had the most desirable nutrient content of all other methods. It is considerably higher in PUFAs and proteins in the pomace will not be as denatured when compared to other processing techniques. However, the practicality becomes an issue for this method. Since the pomace has a very short shelf life, it is not economic to have this feedstuff shipped long distances due to spoilage concerns.

- Feeding Dried – Spreading the pomace as a thin layer and allowing the material to heat and dry was another feasible method of processing. By allowing the pomace to dry, the shelf life can be increased dramatically. Proteins and fatty acids are still denatured; however, it allows the feedstuff to be transferred long distances.
- Fermentation – Fermenting the product and turning it into silage had some significant and drastic effects on the feedstuff profile. The proteins, plant tissues, and fatty acids were denatured heavily. However, the crude protein (CP) percentage increased. By allowing the naturally occurring microbacteria in the pomace to digest the tissues in an anaerobic environment, the nitrogen produced by the bacteria as waste was reallocated in the rumen to create various amino acids. Though this is desirable in one aspect, CP, the PUFAs in the feedstuff was dramatically reduced, thus reducing the amount of readily available energy for the livestock to utilize.

**Project Objectives**

- Understanding the nutrient profile, energy availability, and fatty acid profile in olive pomace,
- Generate quantitative data observing and documenting the fatty acid profiles deposited in muscle and fat tissue of domestic goats when fed high levels of olive pomace,

- Determine the feed efficiency of goats fed varying levels of olive pomace compared to a commercially available, pelleted ration.

# CHAPTER II

## Methodology

This study was divided into two phases to accomplish the objectives. Phase I was to analyze the efficiency and nutrient value of olive pomace after various processing techniques. Phase II was to evaluate performance characteristics throughout the duration of a feeding trial and analyze the deposition, if any, of the oleic acid found in the olive pomace in the meat tissue of goats.

### Evaluating the olive pomace

Olive pomace was collected in 400-gallon containers directly from the milling processes at the time of harvest from producers in Elmendorf, Texas, Dripping Spring, Texas, and Madisonville, Texas. The material was transported to Huntsville, Texas in the temporary storage containers before processing. The fresh pomace was processed by either fermentation, drying, or storage when wet before sending off for near-infrared spectroscopy at SDK Laboratories. The analyses helped determine which of the possible methods of feeding the pomace is the most practical regarding longevity of the material and efficiency in nutrient requirements for livestock producers.

#### PHASE I: Supplementation trial[1]

Twenty-eight Spanish does were fed treatment rations in a commercial type setting to determine the feed efficiency of varying levels of pomace mixed with a

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[1]Trial results presented at 2016 American Society of Animal Science Joint Annual Meeting in Urso, P. M., M. M. Beverly, S. F. Kelley, M. J. Anderson, J. L. Leatherwood, K. J. Stutts, and S. Nair. 2016. Effects of supplementing olive pomace as a feed additive on weight gain in Capris aegagrus hircus. *Journal of Animal Science*. 94, E-Supplement. doi:10.2527/jam2016-1721 and at the 2017 American Society of Animal Science Southern Section Meeting and published in Urso, P. M., M. M. Beverly, S. F. Kelley, M. J. Anderson, J. L. Leatherwood, K. J. Stutts, and S. Nair. 2016. Effects of supplementing olive pomace as a feed additive on weight gain in Capris aegagrus hircus. *Journal of Animal Science*. doi: 10.2527/ssasas2017.0101

commercially available pelleted feed. Four separate groups (*n*=7) were fed 3:1 olive:feed ration, 1:1 olive:feed ration, 1:3 olive:feed ration, and a ration consisting of strictly the pelleted ration. The pellet ration was a commercially available feed from Producers Cooperative Feed Company in Bryan, Texas and consisted of 16% CP. The diets were balanced using the nutrient requirements for maintenance over a 49-day trial. Dietary treatments were offered at 2% BW and consisted of a commercially available pelleted goat-finishing ration along with the chosen level of olive pomace; this added supplement was dependent of the assignment of test and control groups. Molasses was also incorporated into the diet at an additional 0.5% of BW to homogenize the ration and discourage selective browsing. Dietary components were offered at 24-hour intervals each morning for 49 days. Body weights were obtained weekly and intake adjusted accordingly.

The weights taken at seven-day intervals were analyzed by using various statistical methods; average daily gain (ADG), feed efficiency (FE), and the cost efficiency of each ration were determined. By considering the levels at which the animals maintained their weight when exposed to various stressors, it can be better understood how effective the olive pomace is in a commercial setting.

The rations were balanced for net energy for maintenance (NEm) based on the current National Research Council guidelines. With the variances in nutrients available from the different feedstuffs offered, as shown in Table 1, the rations varied between groups.

Table 1. Selected feed values of the rations utilized in the supplementation trial as well as analysis strictly of olive pomace.

| | DM (%)[1] | CP (%)[2] | EE (%)[3] | ADF (%)[4] | NeM (Mcal/lb)[5] | ME (Mcal/lb)[6] |
|---|---|---|---|---|---|---|
| 3:1 Ration | 60.02 | 9.82 | 8.95 | 28.25 | 0.80 | 1.16 |
| 1:1 Ration | 67.32 | 11.88 | 7.05 | 21.44 | 0.83 | 1.19 |
| 1:3 Ration | 74.58 | 13.38 | 5.48 | 18.65 | 0.83 | 1.19 |
| Control | 84.09 | 15.23 | 4.23 | 16.02 | 0.83 | 1.20 |
| Olive Only | 33.07 | 6.85 | 15.60 | 50.47 | 0.73 | 1.08 |

[1]Percent Dry Matter
[2]Percent Crude Protein
[3]Percent Ether Extract
[4]Percent Acid Detergent Fiber
[5]Net Energy for Maintenance in megacalories per pound
[6]Metaboliazable Energy in megacalories per pound

**PHASE II: Fatty acid deposition in meat and muscle tissue**

Fourteen mature Spanish does were utilized in a randomized design for a 28-day trial. The does were given *ad libitum* feed of strictly olive pomace for 28 days to allow the fatty acids in the pomace to be absorbed, should micro bacterial activity allow. Since all fourteen does received the same diet, blood samples were taken for further analysis of FAs in the serum. Blood was collected bi-weekly to determine if the circulatory system is a pathway where the fatty acids frequent once consumed. Weights were taken weekly to determine at what levels feed should be increased to maintain a 2% feed intake based on the animals' body weight, or if the pomace is not an adequate feedstuff and causing animals to lose weight.

Blood samples were obtained every 7 days via jugular venipuncture and stored at -20°C for analysis of fatty acid methyl esters concentrations and to extract any residual C18:1 and other select fatty acids seen in Table 2 that may be present.

Table 2. Select fatty acid concentration levels in olive pomace as seen in Zambiazi et al (2007).

| Fatty Acid | C16:0 | C18:0 | C18:1 | C18:2 | Total |
|---|---|---|---|---|---|
| % in Olive Pomace | 9.31 | 3.2 | 74.0 | 10.33 | 96.84 |

The does were kept in a dry feedlot setting at Gibbs Ranch in Huntsville, Texas in order to minimize unforeseen and unaccounted nutrients from forage and to mimic the conditions in which most cattle and other meat producing livestock are fed.

All data was analyzed using the PROC MIXED procedure of SAS. Models contained effects for dietary treatment, time, and treatment by time interaction. All samples were sent to an independent laboratory for fatty acid methyl ester analysis. The laboratory identified the fatty acid profile of the blood taken in order for the investigators of this study to attempt to find any correlations using PROC CORR procedure in SAS with the amount of olive pomace fed and the profiles present.

# CHAPTER III

## Results, Discussion, and Implications

### Results

#### Supplementation trial

Within the commercial based feeding trial, there was no significant correlation between the feeding groups over time. Across all groups, 3:1 olive to feed, 1:1 olive to feed, 1:3 olive to feed, and the control, the average daily gain (ADG) remained constant ($P$>0.88) as seen in figure 1.

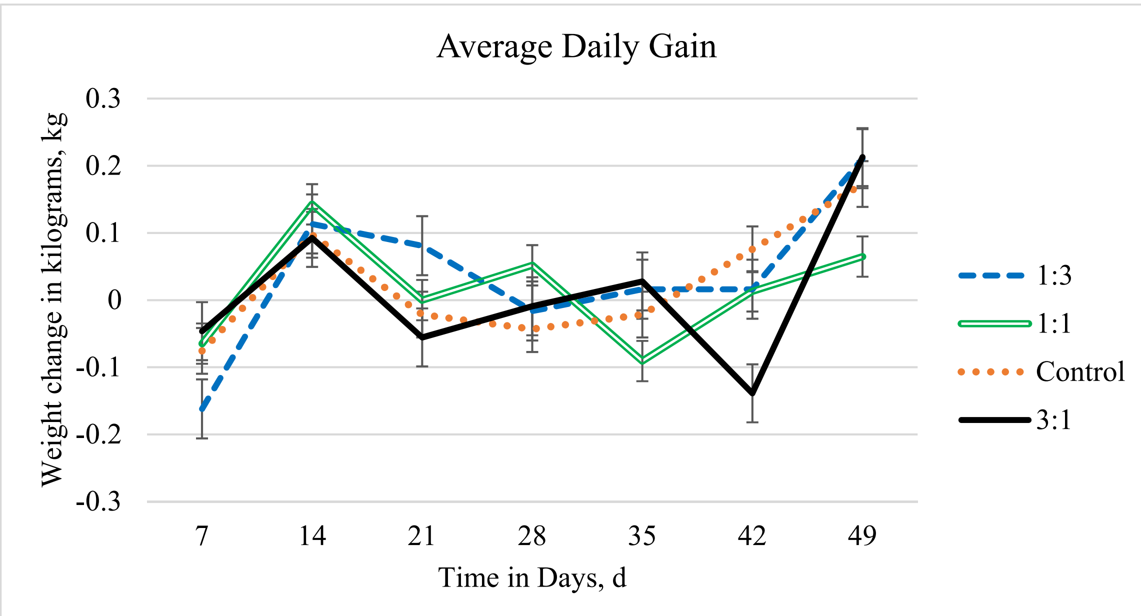


Figure 1. The average daily gain of goats fed various treatment groups differing in olive content over 49 days.

The average consumed in each group varied significantly across treatment ($P$<0.0001) as seen in figure 2. On average, the control group consumed 0.693 kg/d, the 1:3 group consumed 0.7311 kg/d, the 1:1 group consumed 0.6823 kg/d, and the 3:1 group consumed 0.7847 kg/d.

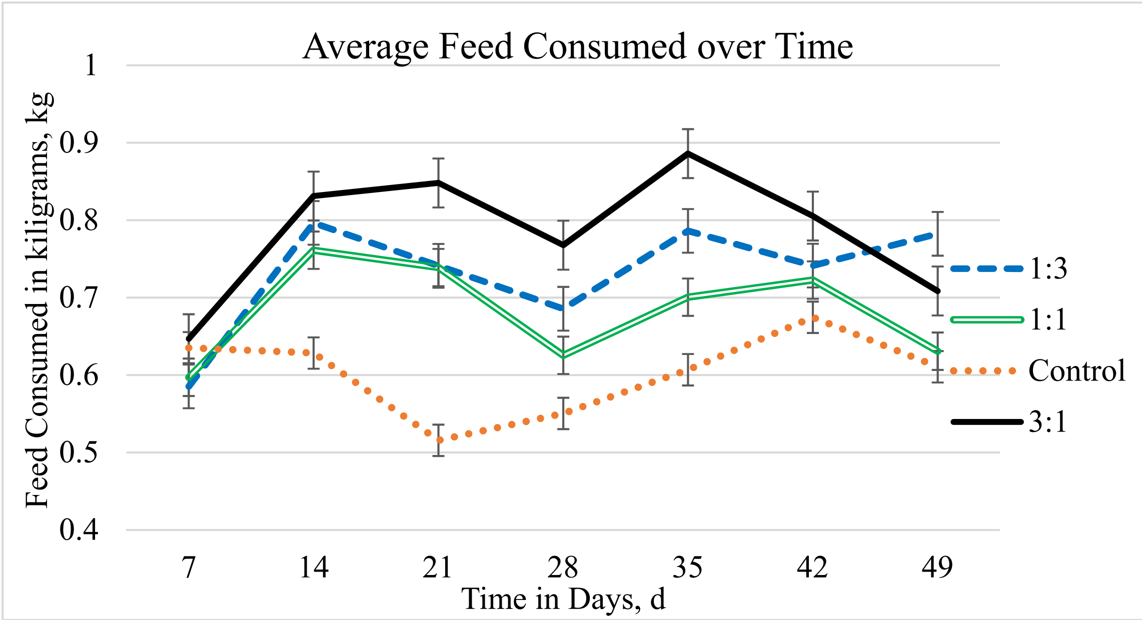


Figure 2. The average amount of feed consumed per day by each group over a 49-day period.

The average efficiency, as seen in figure 3, showed no significant difference between treatment groups (*P*>0.96). The LS mean of each group is as follows: 1:3 gained 0.31 kg of weight for 1 pound of feed, 1:1 gained 0.16 kg, 3:1 gained 0.14 kg, and the control gained 0.26 kg.

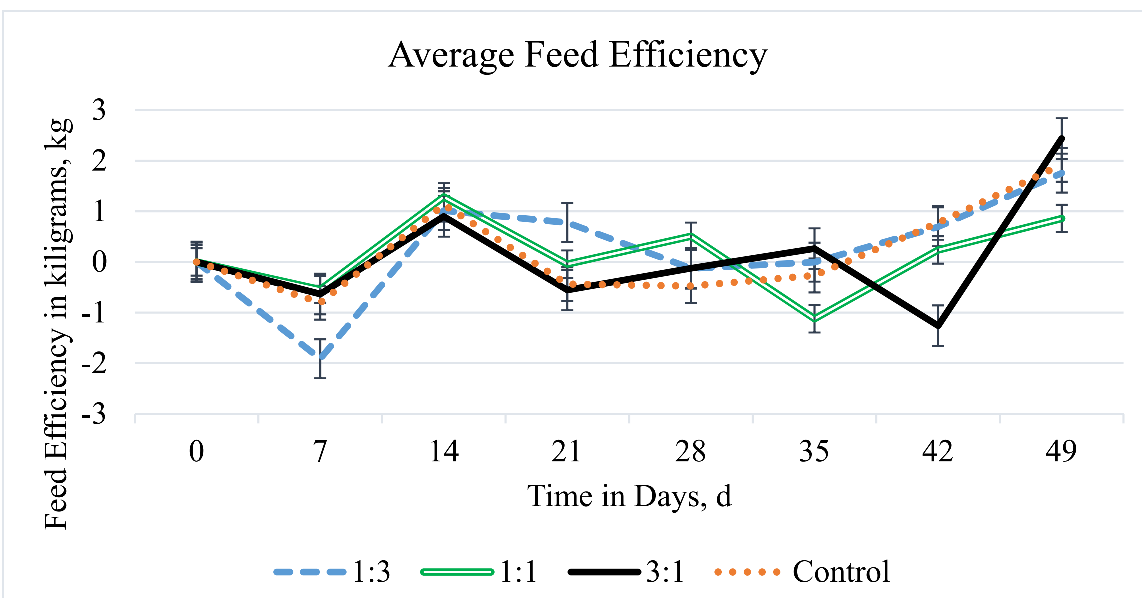


Figure 3. The average feed efficiency of each group over 49 days.

A cost analysis was run via STATA to determine the amount saved by producers using olive pomace as a supplement. There was a significant difference in the cost per ration (*P*<0.0001). The 3:1 ration cost on average \$0.84 per animal per day, the 1:1 ration cost \$1.81, the 1:3 ration cost \$2.64, and the control cost \$2.76 as seen in figure 4.

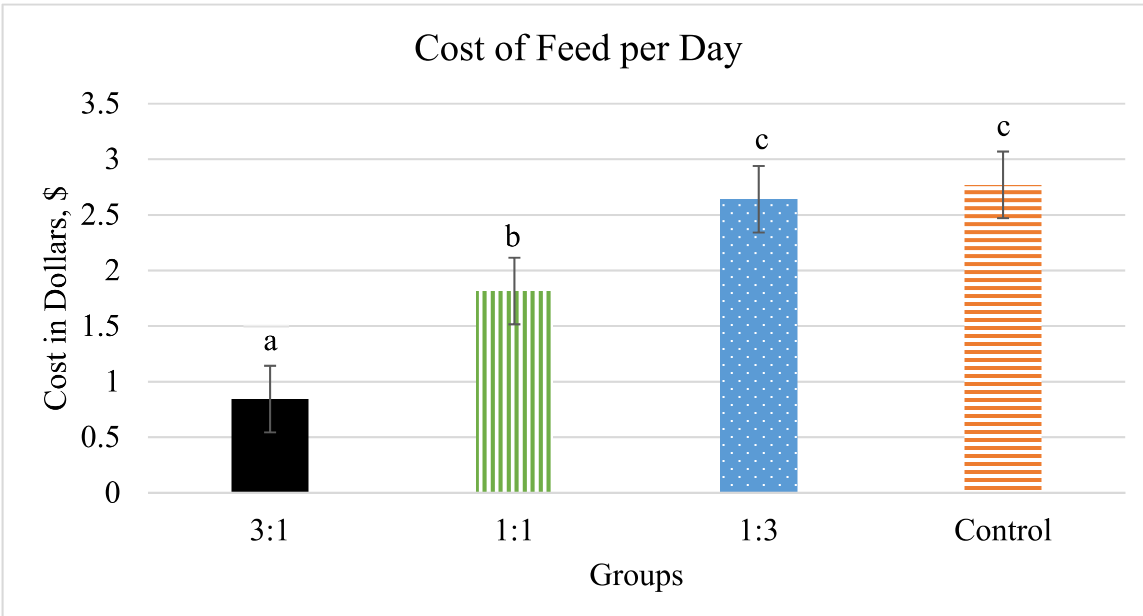


Figure 4. The average cost of feed per animal per week over a 49-day trail.

**Fatty acid trial**

Regarding fatty acid composition there were significant changes in C18:1, C18:2 and C18:0 over time as seen in Figure 5. Over 28 days, the concentration of C18:1 in blood increased by 8.67 percent (*P*<0.004). There was a tendency of C18:0 to increase by 3.59% (*P*<0.09) and a significant increase in C18:2 by an average of 4.38 percent (*P*<0.035). C16:0 was also recorded with no significant change noticed (*P*>0.2).

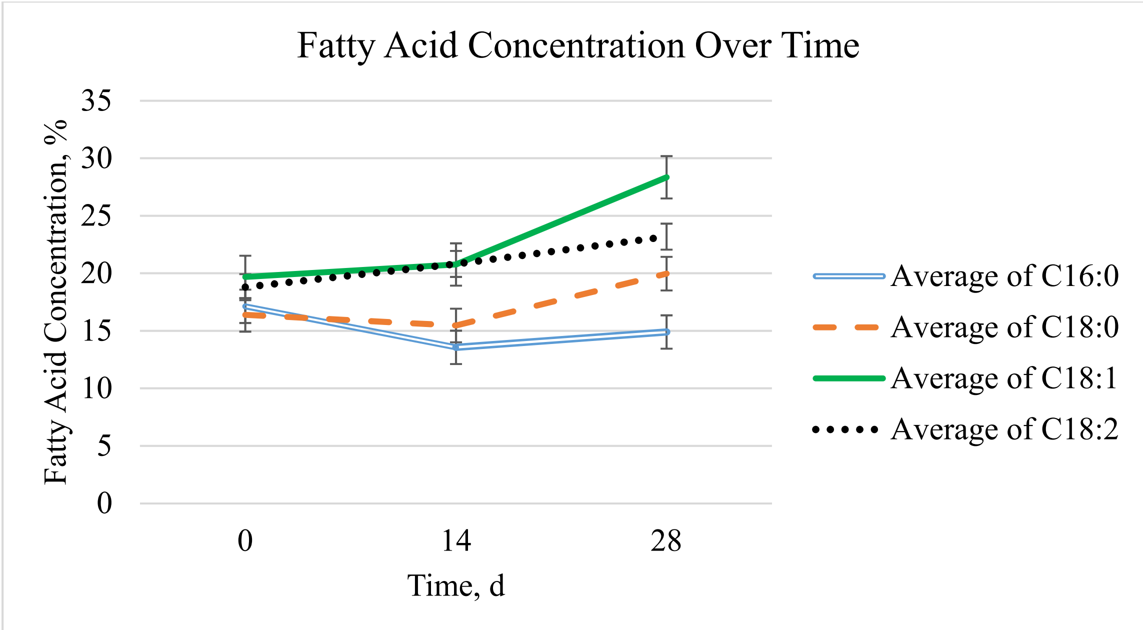


Figure 5. The concentration of fatty acids in goat's blood with noticeable changes over time after analysis of fatty acid methyl esters.

The average amount of feed consumed over time increased (*P*<0.001) as seen in figure 6. At day 7, animals were consuming an average of 0.44 kg/day whereas by day 28, consumption was up to 0.66 kg/day.

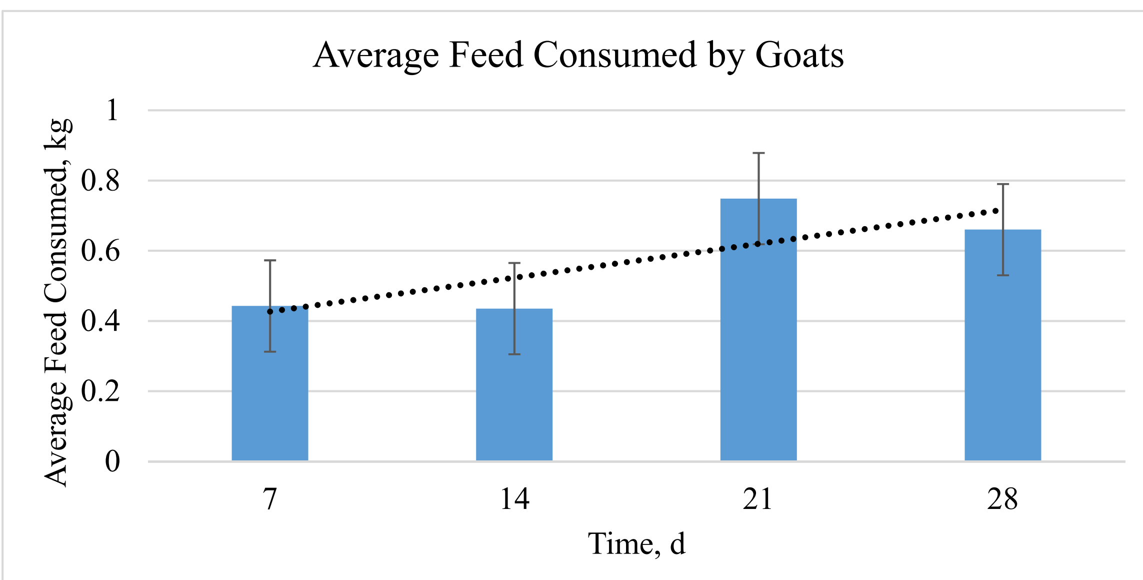


Figure 6. The average feed consumption of does over a 28-day period of *ad libitum* olive pomace. Days are averaged into a single week format.

## Discussion

### Supplementation trial

The average daily gain for each group remained consistent in the commercially based trial. While this ration was balanced for NEm, certain environmental and stress factors could have influenced weight gain or loss overtime. By understanding that olive pomace can be supplemented at inclusion rates of 3:1 olive to feed, the mostly olive ration can be considered as efficient in managing weight over the wintering period when compared back to a commercially available ration. This is partially due to the amount of fat content in the predominantly olive ration. The olive pomace cannot be considered a complete ration, as the CP levels are not sufficient to maintain a constant weight. However, when mixed with the high protein ration, the CP increases to an amount that is suitable for NEm. With this considered the amount of fat that remains in the pomace from the milling process is enough to promote healthy weight maintenance with the correct roughage available.

The amount consumed potentially portrays a difference in palatability. The 3:1 group, which was mostly olives, consumed significantly more feed per week than their control counterparts on average. This difference can potentially be explained by the sweetness of scent and flavor observed in the olive pomace after the fermentation process. After a brief adjustment period to the pomace, the subjects in the pomace groups were more eager to consume their daily ration, thus leaving less waste. Buchanan-Smith (1990) found different results when feeding sheep varying qualities of silage to increase consumption. It was observed that sheep decrease consumption when fed silage. In this study, goats were much more likely to consume higher amounts of feed if there were higher levels of pomace included. The pomace might have a different biochemical makeup when compared to Lucerne silage that allows it to be more palatable.

Cost of feed was another variable analyzed. Without considering shipping and storage, the cost to feed one animal per week was significantly different between groups. The 3:1 ration costing $1.92 less to feed per week compared to the control ration. The fact that olive pomace is a by-product with no current place in the market allows this feedstuff to lower the price of an all-inclusive commercial ration. A full cost analysis including the shipping, labor, stoarage, and opportunity costs is still necessary to determine the true profit potential of feeding this medium.

**Fatty Acid Trial**

With the significant change in fatty acid composition over time, it can be noted the biochemical processes in the gastrointestinal tract alter fatty acid composition over time. It was noticed that both C18:0 and C18:1 followed a similar pattern of change ($r$ = 0.682). C18:1, the fatty acid that is the most prominent in olive pomace, increased by 44 percent from day 0 to day 28 on a normalized distribution ($P$<0.002). C18:0 also had a tendency to increase by a total of 22% from day 0 to day 28 ($P$<0.092). This correlation was seen previously by Mosley et al. (2002), who stated that biohydrogenation of C18:1 by mixed ruminal microbes involves the formation of several positional isomers of *trans* monoenes, as well as the contributing to the direct biohydrogenation to C18:0. It is also observed in the trial that C18:2 increased at a constant level throughout feeding. This is likely contributed to C18:2 being the second most prominent FA in the pomace. However, a slight amount can potentially be contributed classifying olive pomace as a plant-based product because of the minimal processing since its harvest. Marín et al.

(2015) showed that goats fed plant-based diets showed a linear increase in C18:0, C18:1, and C18:2. The spike from day 14 to day 28 and consistent climb in C18:2 is consisted with the theory that C18:2 is saturated into C18:1 and then further into C18:0. The consistent 10.33% concentration of C18:2 supplemented in the feed can potentially explain the gradual linear increase of C18:2. While previous research has shown similar results, it is difficult to say with certainty that biohydrogenation of C18:2 into C18:1 and eventually C18:0 occurred in this study.

It is also noted that the consumption of the pomace increased over time. The consistency of the consumption can also contribute to the gradual rise in C18:2. The goats on trial did in fact decrease consumption between day 7 and 14. This is likely due to the acclimation period accompanied with feeding a silage-based product as well as adverse weather condition during that time. As their feed intake increased, the amount of the observed fatty acids increased as well.

Another saturated fatty acid that was observed in this trial was C16:0. There was no significant difference in the concentration of C16:0 from day 0 to day 28. This can lead to the observation that while saturation occurs with the 18 carbon fatty acids, the loss of carbons is not as prevalent.

**Implications**

By increasing the incidence of C18:1 in the blood, it is hopeful that further saturation or loss of carbons does not occur and the fatty acids are deposited in the muscle tissue. A continuation of this trial at a later date will examine the concentration of the fatty acid profile of muscle biopsies. Jones et al. (2014) stated that C18:1 enriched canola oil can contribute to a lower risk of cardiovascular disease. If C18:1 is deposited in the muscle tissue as it was seen in the blood of this trial, feeding olive pomace can be a healthy alternative to high starch ingredients such as corn and barley.

The reduced cost of the ration seen in the commercial based trial can be a benefit to not only producers of olive oil but also livestock producers. Other by-products such as dried distiller's grains have made a substantial economic benefit in the animal agriculture industry. With further research, olive pomace may contribute to the economic wellbeing to producers as well.

This trial was conducted with the upmost regard and dedication to producing results that were depended on the variables tested and not negligence of following protocol. However, there were external factors that were not in the control of the researchers. The goats utilized in this trial were purchased from an independent auction in San Angelo, Texas. These goats were ideal for the conducting of this trial. All of the animals were previously from a single producer, were of relatively the same age, and were fed the same diet before the introduction into this trial. Ten individuals from the herd were covered by a buck days before purchase by Sam Houston State University and therefore were in a different physiological stages during the trial. These individuals were excluded from both trials so their rapid weight gain would not skew the true results of the olive pomace as a feed variable.

**Conclusion**

With the conclusion of the pilot feeding trial for olive pomace, it was observed that supplementation of the ingredient can be beneficial to the animals that consume it. It can also be a benefit to the producers that feed this medium as it can potentially be obtained cheaper than a commercially available ration. Future studies can observe more specific inclusion rates to determine the olive pomaces' optimum efficiency level. Economic investigation can also reveal the pomaces' true economic value.

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**VITA**

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Department of Agricultural Sciences and Engineering Technology
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Animal Science Teaching Assistant
Department of Agricultural Sciences and Engineering Technology
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**Education**

Agriculture, Ruminant Nutrition Focus, M.S. Sam Houston State University – May 2017
Animal Science, Biology Concentration, B.S. Sam Houston State University – May 2015

**Professional Certifications**

Beef Quality Assurance Certified – 2014
International Animal Care and Use Certified – 2014
Collaborative Institutional Training Initiative - 2014

**Peer Review Publications**

**Urso. P. M.,** M. M. Beverly, S. F. Kelley, M. J. Anderson, S. Nair, J. L. Leatherwood, K. J. Stutts. (2016). The Effects of Supplementing Olive Pomace as a Feed Additive on Weight Gain in *Capris aegagrus hircus. Journal of Animal Science*

Beverly, M. M., **P. M. Urso**, A. R. Tipton, S. F. Kelley, and J. F. Wilson. (2015). Assessing Flight Zones and Acclimation Periods of Various Livestock Species when Exposed to Unmanned Aerial System. *Journal of Animal Science.*

**Peer Review Presentations/Posters**

Beverly, M. M., S. F. Kelley, **P. M. Urso**, M. J. Anderson. (2016). Student Perspectives on Agricultural Study Abroad Programs. *North American Colleges and Teachers of Agriculture.* Poster Presentation.

Beverly, M. M., S. F. Kelley, **P. M. Urso**, C. N. Wellmann. (2016). Student Definition and Perception of Sustainable Agriculture. *North American Colleges and Teachers of Agriculture.* Poster Presentation.

Fenske, K. A., J. L. Burke, **P. M. Urso,** M. M. Beverly, S. F. Kelley, M. J. Anderson. (2016). The Effects of Olive Pomace on Weigh Gain and Average Daily Gain on *Capris aegagrus hircus* as a Model for Ruminants. *Ag Consortium of Texas.* Poster Presentation.

**Urso. P. M.**, M. M. Beverly, A. R. Tipton, S. F. Kelley, and J. F. Wilson. (2015). Assessing Flight Zones and Acclimation Periods of Various Livestock Species when Exposed to Unmanned Aerial System. *Undergraduate Research Symposium at Sam Houston State University.* Oral Presentation.

**Urso. P. M**., M. M. Beverly, A. R. Tipton, S. F. Kelley, and J. F. Wilson. (2015). Assessing Flight Zones and Acclimation Periods of Various Livestock Species when Exposed to Unmanned Aerial System. *Ag Consortium of Texas.* Poster Presentation.

**Urso, P. M**., G. G. Vann, M. J. Anderson, M. M. Beverly, K. J. Stutts. (2015). Investigating the Effects of Body Weight, Loin Eye Area, and Fat Deposition of Conjugated Linoleic Acids on *Sus scrofa. Undergraduate Research Symposium at Sam Houston State University.* Poster Presentation.

**Work Experience**

Animal Science Teaching Assistant/Laboratory Coordinator, Sam Houston State University – 2015 to present

Facilitated animal science courses as needed in regards to grading, course work, and classroom instruction. Updated curriculum of courses and continue correspondence of all Animal Science Teaching Assistants so that the level of interest and engagement in the classroom remains beneficial to student learning environment.

Assistant Livestock Judging Coach, Sam Houston State University – 2015 to present

Organized travel expense reports and reservations. Explained to individuals the importance of livestock selection while discussing desirable traits within all the livestock species.

Research Assistant, Sam Houston State University – 2014 – 2015

Assisted with various research projects conducted by the Department of Agricultural Sciences and Engineering Technology. Managed animal husbandry facilities and fed animals on a strict schedule.

Lead Tutor, Sam Houston State Writing Center – 2012 to 2015

Trained and organized newly hired tutors. Managed facilities after hours when office directors were not present. Assisted in the furthering of students in the English language writing style and techniques.

Veterinary Technician, Kaufman Veterinary Clinic – 2007-2011

Assisted veterinarian with daily medicinal duties on-site and on-farm. Maintain sanitary environments to minimize risks of infection. Handled large animals minimizing stress pre-operation.

**Academic Courses Facilitated as Instructor**

<u>Sam Houston State University</u>

ANSCI 1119: Introductory Animal Science Laboratory
ANSCI 3363: Anatomy and Physiology of Domestic Animals

**Academic Courses Facilitated as Teaching Assistant**

<u>Sam Houston State University</u>

ANSCI 1319: Introductory Animal Science
ANSCI 2321: Livestock Evaluation and Selection
ANSCI 3336: Livestock Marketing
EQSCI 3340: Equine Behavior and Training
ANSCI 3363: Anatomy and Physiology of Domestic Animals
ANSCI 3373: Animal Nutrition
ANSCI 3376: Meat Science
ANSCI 4310: Animal Growth and Performance

ANSCI 4336: Stocker and Feedlot Management
ANSCI 4337: Behavior and Management of Domestic Animals
ANSCI 4394: Animal Feeds and Feeding

**Honors and Awards**

NACTA Outstanding Efforts in Graduate Teaching
2016
National Agri-Marketing Association Adviser 2016
Ann Christian Memorial Service Award Winner 2015
College of Sciences “Sammy” Award Winner for Service 2015

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|---|---|
| Star of Texas Junior Heifer Show Intern | 2014, 2015, 2016 |
| Delta Tau Alpha Honor Society, Vice President | 2013-2015 |
| Department of Agriculture Sciences Homecoming King | 2014 |
| Alpha Lambda Delta Honor Society | 2011-2015 |
| Golden Key Honor Society | 2014-2015 |
| Houston Livestock Show and Rodeo Scholarship Recipient | 2014 |
| Journal of Animal Science Outstanding Student Nomination | 2014 |
| Who's Who Among America's College Students Nomination | 2014 |

**Committees Served**

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| Academic Review Panel | 2016-2017 |