

EFFECTS OF SUPPLEMENTATION OF EXPIRED HUMAN FOODSTUFFS ON INTAKE AND DIGESTION BY WETHERS FED A BASE DIET OF GRASS HAY AND ALFALFA/BARLEY PELLETS

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Impact Statement

There is potential for expired human foodstuffs to be used as an energy supplement for livestock.

In our study, no particular treatment stood out as superior or inferior in digestibility or DMI compared to the whole barley diet. Expired human food products (macaroni, potato chips, and donuts) did not impact intake of low-quality forage or measures of digestibility. Using expired human foodstuffs as an energy supplement for livestock may be an expense saving opportunity for producers, as well as a favorable disposal option for otherwise wasted products. Increasing production costs challenge livestock producers to investigate novel sources of feed. Expired human foodstuffs could provide an economical alternative to traditional energy supplements, without substantial negative impacts on intake or digestibility. Further studies on production parameters such as BW gain and feed efficiency in larger numbers of animals in different stages of production are warranted.

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SUMMARY

There is potential for expired human foodstuffs to be used as an energy supplement for livestock. Sixteen crossbred wether lambs were used in a completely randomized design to investigate the effects of feeding supplemental expired human foodstuffs on DM, OM, ADF and NDF digestibility, and intake. Wethers were fed (DM basis) isocaloric amounts of the following treatments: whole barley served as the control (**BAR**: 0.44 lb·wether⁻¹·d⁻¹), potato chips (**PC**: 0.33 lb·wether⁻¹·d⁻¹), macaroni (**MAC**: 0.46 lb·wether⁻¹·d⁻¹), and donuts (**DON**: 0.33 lb·wether⁻¹·d⁻¹). Wethers were fed 1.32 lb·wether⁻¹·d⁻¹ alfalfa/barley pellets and allowed ad libitum access to chopped hay. Wethers were placed in confinement crates for a 7-d acclimation period, fitted with fecal bags on d 0 and fed twice daily. Following acclimation, daily intakes, refusals, and fecal outputs were used to determine DM, OM, fiber digestibility and intake. Measures of intake and digestibility did not differ ($P > 0.23$) among treatments. It is concluded that these expired human foodstuffs have the potential to be used in ruminant diets as an alternative to traditional feedstuffs.

INTRODUCTION

Every year, large quantities of retail food products are removed from the supply chain because they have expired. In 2001, more

than \$900 million of expired food was wasted (GMA, 2002). Forty percent of food in the United States goes uneaten, which is the equivalent of throwing \$165 billion dollars into landfills (NRDC, 2012). In the last 10 years, barley, a common traditional energy supplement for livestock, has increased in price by 124% (NASS, 2012). As an alternative to expensive energy supplements, expired human foodstuffs may have the potential to be part of a ration for livestock, as well as provide an environmentally friendly method of disposal.

Sources of supplemental energy traditionally have included grains, readily digestible-fiber sources, and high-quality forages. The objective of this study was to compare daily intakes and digestibility of DM, OM, ADF, and NDF of sheep fed chopped hay and alfalfa/barley pellets and supplemented with expired human foodstuffs (macaroni, potato chips, and donuts).

PROCEDURES

All animal use procedures were approved by the Montana State University Animal Care and Use Committee (Protocol #1144). Sixteen crossbred wether lambs (Suffolk/Hampshire x Western white face; 6-mo-old; BW = 83.6 ± 4.4 lb) were used in a completely randomized design to investigate the effects of feeding supplemental expired human food on the intake and digestibility of treatment diets.

Treatments were: barley fed at 0.44 lb·wether⁻¹·d⁻¹ (**BAR**), potato chips fed at 0.33 lb·wether⁻¹·d⁻¹ (**PC**), macaroni fed at 0.46 lb·wether⁻¹·d⁻¹ (**MAC**), and donuts fed at 0.33 lb·wether⁻¹·d⁻¹ (**DON**), all on a DM basis. Treatments were formulated to be isocaloric based on NRC (1985) estimated TDN values for barley, brome grass hay, and alfalfa, and calculated TDN values of macaroni, donuts, and potato chips based on estimated nutrient content (USDA, 1999) (Tables 1 and 2). Wethers were allowed ad libitum access to chopped-grass hay and fed 1.32 lb·wether⁻¹·d⁻¹ of an 80% alfalfa, 20% barley pellet (DM basis) to insure adequate CP intake.

Wethers were housed in metabolism crates (30 in x 50 in), fitted with fecal bags at the beginning of the acclimation period, and allowed a 7-d period to acclimate to diets and environment. The study took place under 24 h light. Wethers were offered total respective treatments and a half ration of chopped hay (60% of previous day's intake) and 0.66 lb·wether⁻¹·d⁻¹ of alfalfa/barley pellets at 0600 h. The remaining chopped hay (60% of previous day's intake) and 0.66 lb·wether⁻¹·d⁻¹ of alfalfa/barley pellets were fed at 1600 h. Feed samples were taken daily, and each feedstuff was compiled over the 7-d period for later analysis. At the end of the 7-d trial, total fecal weights for each lamb were recorded, and a subsample of feces was gathered and composited by animal for determination of nutrient component analyses, DMI, OM intake, DM digestibility, NDF digestibility, and OM digestibility *in vivo*.

Daily intakes and digestibility of DM, OM, ADF, and NDF were calculated. Data were analyzed using the GLM procedure of SAS (SAS Inst. Inc., Cary, N.C.), with expired feedstuff as the fixed effect. Animal was considered the experimental unit. Differences among treatments were considered significant at $P < 0.10$.

RESULTS AND DISCUSSION

Three wethers were removed from the trial during the adaptation period, two from the MAC treatment and one from the PC treatment, due to inability to adjust to the research environment. Daily intakes of each treatment ingredient, alfalfa/barley pellets, and chopped hay are presented in Table 2. Wethers consumed all of the alfalfa/barley pellets and treatment ingredients provided.

Total diet digestibility of DM, OM, NDF, and ADF is presented in Table 3. Measures of intake and digestibility did not differ ($P > 0.23$) among treatments. Compared to the BAR control treatment in our study, none of the expired foods impacted either measures of intake or digestibility when fed at an equivalent of 20% barley in the diet or the barley equivalent of 0.50% of BW.

The PC supplement contained the most fat (Table 1) of all the treatments, but did not negatively impact digestibility. Nutrient variation for by-product feeds, such as those examined in this study, can be considerable depending on factors, such as source, basal ingredients, and manufacturing processes.

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Table 1. Analysis of dietary components¹

| Item | Chopped hay | Alfalfa/barley pellets | Barley | Donuts | Macaroni | Potato Chips |
|------------------------|-------------|------------------------|--------|--------|----------|--------------|
| DM, % | 92.1 | 96.2 | 91.7 | 83.8 | 92.7 | 97.9 |
| OM, % | 91.2 | 89.5 | 98.6 | 98.1 | 99.1 | 94.9 |
| NDF, % | 58.8 | 48.2 | 20.3 | 5.4 | 8.4 | 3.8 |
| ADF, % | 40.5 | 37.6 | 16.9 | 4.7 | 7.6 | 3.0 |
| CP, % | 9.0 | 16.8 | 10.6 | 5.2 | 13.0 | 7.9 |
| EE ^{2,3} , % | 1.0 | 1.3 | 1.8 | 28.5 | 1.7 | 33.0 |
| TDN ^{2,4} , % | 58.1 | 68.3 | 88.0 | 118.7 | 85.4 | 119.4 |

¹All values presented on DM basis. Dietary composition was determined by analyzing subsamples collected and composited throughout the trial. Accuracy was ensured by adequate replication with acceptance of mean values that were within 5% of each other.

²Values for Donut, Macaroni, and Potato Chips calculated based on energy values from National Nutrient Database for Standard Reference (USDA, 1999). Values for Chopped hay and Alfalfa/barley pellets taken from NRC (1985).

³EE = ether extract.

⁴TDN, % = (0.5 x %Crude Fiber) + (0.90 x %Nitrogen-Free Extract) + (0.75 x %Crude Protein) + (2.25 x 0.90 x %Ether Extract)

Table 2. Actual amounts of feed ingredients consumed by wethers with ad libitum access to chopped hay and supplemented with isocaloric treatments and alfalfa/barley pellets (0.60 kg·wether⁻¹·d⁻¹)¹

| Item | BAR ² | DON ³ | MAC ⁴ | PC ⁵ | SE |
|--|------------------|------------------|------------------|-----------------|-------|
| No. of wethers | 4 | 4 | 2 | 3 | — |
| Treatment DMI, lb ⁶ | 0.44 | 0.33 | 0.46 | 0.31 | — |
| Alfalfa/barley pellet DMI, lb ⁶ | 1.32 | 1.32 | 1.32 | 1.32 | 0.000 |
| Chopped hay DMI, lb ⁶ | 0.75 | 0.95 | 1.10 | 0.90 | 0.056 |

¹All values presented on DM basis. Dietary composition was determined by analyzing subsamples collected and composited throughout the trial. Accuracy was ensured by adequate replication with acceptance of mean values that were within 5% of each other.

²Fed barley at 0.44 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

³Fed donuts at 0.33 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

⁴Fed macaroni at 0.46 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

⁵Fed potato chips at 0.33 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

⁶Mean daily DMI over 1 wk trial.

Table 3. Diet digestibility of wethers fed alfalfa/barley pellets (0.66 kg·wether⁻¹·d⁻¹), expired human foodstuffs, and chopped hay (ad libitum access)

| Item | BAR ¹ | DON ² | MAC ³ | PC ⁴ | SE |
|-------------------|------------------|------------------|------------------|-----------------|------|
| No. of wethers | 4 | 4 | 2 | 3 | — |
| Digestibility (%) | | | | | |
| DM | 74.7 | 69.8 | 67.3 | 71.4 | 2.40 |
| OM | 76.1 | 71.1 | 69.0 | 72.6 | 2.32 |
| NDF | 62.9 | 58.1 | 59.3 | 63.8 | 4.02 |
| ADF | 62.4 | 55.0 | 52.7 | 59.1 | 4.24 |

¹Fed barley at 0.44 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

²Fed donuts at 0.15 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

³Fed macaroni at 0.21 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.

⁴Fed potato chips at 0.15 lb·wether⁻¹·d⁻¹, alfalfa/barley pellets at 1.32 lb·wether⁻¹·d⁻¹, and ad libitum access to chopped hay.