BC FoodWeb

Peer-reviewed research

Promising fruit pomaces for broiler chicken feed

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KEY TAKEAWAYS

Researchers studied four fruit pomaces as potential ingredients in chicken feed. Each pomace differed in its levels of usable energy, fibre, protein, and beneficial plant compounds. Pomaces can offer feed formulators options to meet different nutritional goals.

- **Blueberry, cranberry, and grape pomaces contained the highest levels of beneficial plant compounds**. These compounds have antibacterial and antioxidant properties that may help support bird health and gut function.
- Cranberry, blueberry, and grape pomaces lowered blood cholesterol and bile acid levels in broiler chickens, suggesting they may support healthier fat and liver function.
- Apple and grape pomaces provided the most usable energy, while blueberry and cranberry pomaces provided the least. All four pomaces were low in protein and key amino acids, making them **better suited as supplemental ingredients that provide health benefits rather than replacing conventional energy or protein sources.**

How can this research be used?

Researchers found that apple, blueberry, cranberry, and grape pomaces each have unique nutritional profiles and levels of beneficial plant compounds. **These differences can help feed formulators choose pomaces for specific purposes in poultry diets, such as supporting gut health or providing antioxidant benefits.** The findings also highlight opportunities for fruit processors and poultry producers to work together to transform fruit processing by-products into valuable feed ingredients, helping reduce waste and support a more circular food system.

Production Type
- Livestock (poultry)

Practice Benefit(s)
- Improved feed formulation
- Reducing food waste

Research Location
- Guelph Research and Development Centre, AAFC
- Summerland Research and Development Centre, AAFC
- The University of Guelph

Key Terms
- *Fruit pomace:* The leftover fruit material like skins, pulp, and seeds, after juice has been squeezed out or the fruit has been processed.
- *Feed enzymes:* Substances added to feed to help chickens break down ingredients (e.g., fibre) and absorb more nutrients from their food.
- *Beneficial plant compounds:* Natural substances commonly found in plants in small amounts that may support bird health through their properties, such as antioxidants.

Why was the research done?

Fruit and beverage processors generate large amounts of pomace each year, creating an opportunity to use them in poultry feed and reduce food waste. However there is little information on their nutritional and functional values, which makes it difficult for feed formulators to know how to use pomaces as poultry feed ingredients. In addition to nutrients and energy, fruit pomaces contain natural plant compounds with potential health benefits. For example, grape and berry pomaces contain compounds with antioxidant, antimicrobial, and immune-supporting properties that may help support bird health. This may be particularly important in organic poultry systems where antibiotic use is limited.

To better understand the potential role of fruit pomaces in poultry feed, researchers explored two key questions: **(1) How much energy can chickens use from the different fruit pomaces? and (2) Can a multi-enzyme supplement improve the functional values of fruit pomaces by unlocking nutrient and bio-active compounds?** The results provide baseline information to support feed formulation decisions and future research on incorporating fruit-processing by-products into poultry production.

Figure 1. Grape pomace from wine production.

What was the outcome?

Researchers looked at the nutritional and functional values provided to chickens from four different fruit pomaces: apple, cranberry, blueberry, and grape. These pomaces were mixed with conventional diets, making up 30% of the feed ingredients, with no mortality recorded. Some key results are summarised below:

Pomace can effect birds health.

Blueberry, cranberry, and grape pomaces contained higher levels of beneficial plant compounds with antioxidant and antibacterial properties (Table 1). These compounds may help support bird health and gut function, making the pomaces useful to organic producers as potential natural alternatives to antibiotics.

Birds fed cranberry, blueberry, and grape pomace also had lower blood cholesterol and bile acid levels than birds fed apple pomace (Table 2). These lower levels suggest that these pomaces may support better fat handling in birds and reduce blood cholesterol buildup, which could be beneficial for overall bird health and normal liver function.

Pomaces have different amounts of usable energy.

The four fruit pomaces differed in the amount of usable energy they provided to broiler chickens. **Apple pomace supplied the highest amount of usable energy, followed by grape pomace, while blueberry and cranberry pomaces provided less (Table 2)**.

An important part of this research was testing a new approach by adding feed enzymes to see if chickens could get more nutrients from fruit pomace. In this study, adding enzymes to the feed did not increase the energy available to chickens**.** Energy values were similar with and without enzymes (Table 2), suggesting that the choice of pomace may have a greater impact than enzyme supplementation.

The pomaces also differed in their fibre content. Birds fed the apple pomace diet ate the least amount of feed, even though apple pomace had the lowest fibre content, while cranberry and blueberry had the highest, and grape had a moderate amount (Table 1). Fibre can influence how much chickens eat and how well they use nutrients, but this study did not directly test how fibre content affected feed intake.

Pomaces have low protein content.

None of the pomaces provided enough protein to serve as a primary protein source in poultry diets. Blueberry and cranberry pomaces contained more crude protein than apple and grape pomaces, but the differences were minimal (Table 1).

Essential amino acids, including lysine, methionine, and cysteine, were present at much lower levels than those found in conventional feed ingredients such as soybean meals. While these amino acids are important for growth, feather development, and overall bird performance, these fruit pomaces cannot replace traditional protein ingredients. These pomaces would be best used alongside nutritionally balanced feed formulations to provide these benefits.

Table 1. Nutrients and energy composition of apple, grape, blueberry, and cranberry pomace diets before feeding to broiler chickens.

Feed		Control diet	Apple	Grape	Blueberry	Cranberry
Gross Energy (Kcal/Kg)		3939	3881	4077	4428	4460
Crude Protein (%)		16.2	16.4	17.8	15.3	18.0
Crude fat (%)		1.94	2.21	4.56	5.86	9.33
NDF (%)		1.41	4.49	14.2	24.4	29.8
Minerals (% DM)	Calcium	1.26	1.12	1.43	0.94	0.96
	Phosphorus	0.51	0.51	0.53	0.43	0.44
Essentail Amino Acids (% DM)	Lysine	0.50	0.05	0.07	0.07	1.35
	Methionine + Cystine	0.53	0.38	1.89	0.51	0.59
Beneficial Plant Compounds (mg/100g DW)	Total	--	377.5	661.0	1342	733.1
	Anthocyanins	--	8.50	21.50	604.1	92.50
	Flavanols	--	109.5	82.50	445.5	353.2

What's next?

Fruit pomaces have potential as alternative poultry feed ingredients, particularly for producers interested in more natural feed ingredients. However, more work is needed before they can be widely used in commercial diets. Including pomaces at lower amounts (1–5%), improving processing methods to increase digestibility, developing more effective enzyme strategies, and improving consistency in pomace quality will be important for helping feed formulators and poultry producers use these ingredients with greater confidence.

Table 2. Feed intake, nutrient and energy retention, enzyme response, and selected blood measurements in broiler chickens fed diets containing apple, grape, blueberry, or cranberry pomace.

Feed	Feed Intake (g/bird)	Usable energy (kcal/ kg DM)	Gross energy (%)	Crude protein (%)	Crude fat (%)	NDF (%)	Enzyme reaction AME kcal/kg DM		Effects on blood plasma (mol/L)	
							+ ENZ	- ENZ	Cholsterol	Bile acid
Control diet	249	--	--	--	--	--	--	--	--	--
Apple	146	3350	76.1	34.4	45.9	-173	3392	3308	4.1	23.4
Grape	251	3008	70.4	45.6	61.9	17.9	3240	2776	2.9	12.6
Blueberry	280	2613	66.1	54.8	58.2	25.1	2880	2346	2.8	11.1
Cranberry	298	2394	64.6	57.1	72.7	29.6	2512	2277	3.1	15.6

Retention values are reported as percentages. For example, 76.1% gross energy retention means the birds retained just over three-quarters of the energy in the feed.

How was the research done?

We conducted this study at the University of Guelph in 2018 to measure the nutritional value of four fruit pomaces under controlled conditions rather than test a complete commercial feeding program. This allowed us to compare the pomaces directly and generate baseline information for future studies using practical poultry diets and commercially relevant inclusion rates.

We looked at the amount of usable energy from **apple, grape, cranberry, and wild blueberry pomaces** using 360 one-day-old Ross 708 male broiler chicks. The birds were housed in groups of five and fed a commercial diet until they were 13 days old. The birds were then switched to four experimental diets – one for each fruit pomace.

Figure 2. Fruit pomaces in bags. Photo from AAFC.

Each experimental diet contained **30% pomace** and was tested **with and without a commercial multi-enzyme supplement**. The enzyme blend contained several enzymes commonly used in poultry nutrition to help break down fibre and other complex carbohydrates. This allowed us to determine whether enzymes could make nutrients in the diet more available to chickens during digestion. We also included a control diet without pomace, giving a total of **nine dietary treatments**.

From days **17 to 20**, we collected excreta samples to measure how much energy and nutrients the birds were able to get from each diet. On day **21**, we collected blood samples from one bird in each cage to see how different diets changed blood protein, enzymes, and metabolites (e.g., cholesterol). We also analysed each pomace for its fibre, starch, protein, fat, mineral, and sugar content, as well as the amount of natural plant compounds which have health properties (e.g., antioxidants).

About this brief

This brief was prepared by Yussuf Adedeji and Nisa Chavez from the BC Food Web team, with the help of Kelly Ross, and is based on the following scientific journal article:

- Kithama, M., Ross, K., Diarra, M. S., & Kiarie, E. G. (2023). Utilization of grape (Vitis vinifera), cranberry (Vaccinium macrocarpon), wild blueberry (Vaccinium angustifolium), and apple (Malus pumila/domestica) pomaces in broiler chickens when fed without or with multi-enzyme supplement. Canadian Journal of Animal Science, 103(1), 15–25. https://doi.org/10.1139/cjas-2022-0016

Want to learn more?

- For any questions regarding this research, contact Kelly Ross at kelly.ross2@AGR.GC.CA

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