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# Yellow-seeded *B. napus* and *B. juncea* canola. Part 2. Nutritive value of the meal for turkeys☆

K. Kozlowski[a], D. Mikulski[a], A. Rogiewicz[c], Z. Zdunczyk[b], M. Rad-Spice[c], H. Jeroch[a], J. Jankowski[a], B.A. Slominski[c,*]

[a] Department of Poultry Science, University of Warmia and Mazury, 10-719 Olsztyn, Poland
[b] Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, 10-748 Olsztyn, Poland
[c] Department of Animal Science, University of Manitoba, Winnipeg, R3T 2N2, Canada

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ABSTRACT

For the effective utilization of meals derived from the newly developed yellow-seeded canola varieties in turkeys' diets, it is critical to determine their nutritive value and their impact on growth and digestive physiological responses and the potential benefit of enzyme supplementation. Thus, the standardised ileal amino acid digestibility (**SIAAD**) and nitrogen-corrected apparent metabolisable energy (**$AME_n$**) content of *B. napus* yellow, *B. juncea* yellow and *B. napus* black canola meal (**CM**) and the effect of feeding 200 g/kg of the meals on growth performance and gut physiological responses with or without a multi-carbohydrase enzyme we determined. For the SIAAD assay, semi-purified diets containing the CM types were fed to turkeys of 21–28 d of age. For the $AME_n$ assay, diets containing 300 g/kg of the CM types without or with a multi-carbohydrase enzyme were fed to turkeys of 35–40 d of age. The growth performance study was a 5 × 2 factorial arrangement to evaluate the effects of feeding 200 g/kg of the CM types (i.e., Control, *B. napus* black from Canada and Poland, *B. napus* yellow, and *B. juncea* yellow) without or with enzyme on growth performance and gut physiological responses of turkeys. There were no differences among CM types in the SIAAD coefficients and $AME_n$ content. Standardised ileal digestible amino acids contents were higher in *B. juncea* meal (28.3, 15.5 and 14.6 g/kg for arginine, lysine, and threonine, respectively) compared to *B. napus* yellow (23.7, 18.5, and 14.6 g/kg) and *B. napus* black (21.5, 17.5, and 13.3 g/kg) meals. The $AME_n$ contents of *B. juncea*, *B. napus* yellow, and conventional *B. napus* black were 9.51, 9.28, and 8.97 MJ/kg, respectively. In the growth performance study, feed intake and body weight gain did not differ among treatments. However, during the starter phase, there was an effect of diet on the feed conversion ratio with *B. napus* black (Canada and Poland) having the highest. Feed conversion was improved by enzyme supplementation. There was a significant effect of enzyme supplementation on the content of short chain fatty acids in cecal digesta with an increase in acetic and butyric acids, the latter one known to be beneficial in controlling enteric pathogens and in improving gut health. In conclusion, 200 g/kg of all the CM types can be used effectively to replace soybean meal in diets for turkeys when diets are formulated on digestible amino acids and $AME_n$ basis.

*Abbreviations:* CM, canola meal; NSP, non-starch polysaccharides; AMEn, nitrogen-corrected apparent metabolisable energy; AID, apparent ileal digestibility; BWG, body weight gain; FCR, feed conversion ratio; EL, endogenous losses; SID, standardised ileal digestibility; SIAAD, standardised ileal amino acid digestibility; SCFA, short chain fatty acids

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* Corresponding author.
*E-mail address:* bogdan.slominski@umanitoba.ca (B.A. Slominski).

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## 1. Introduction

Meals derived from yellow-seeded *Brassica napus* canola and canola-quality (low-glucosinolates, low-erucic acid) forms of *B. juncea* mustard have shown quality characteristics superior to those of the conventional *B. napus* meal (Jia et al., 2012; Slominski et al., 2012; Radfar et al., 2017; Rad-Spice et al., 2017). The *B. juncea* mustard, which is known for its pure yellow seed coat color, and yellow-seeded *B. napus* canola have been developed as a means of improving the quality of CM and increasing the oil content in the seed. Slominski et al. (2012) and Radfar et al. (2017) reported that both CM types have more sucrose and less total dietary fibre (primarily resulting from lower contents of lignin with associated polyphenols) than the conventional *B. napus* CM. In the accompanying Part 1 of this series (Rad-Spice et al., 2017), the nutritive value of meals derived from yellow-seeded *B. napus* and *B. juncea* in comparison with the conventional black-seeded *B. napus* was determined with broiler chickens. It was observed that *B. juncea* CM had significantly higher nitrogen corrected apparent metabolisable energy (**$AME_n$**) content and standardised ileal digestible content of amino acids for broiler chickens than the black- and yellow-seeded *B. napus* meals. Jia et al. (2012) also observed a higher $AME_n$ content in *B. juncea* meal than the conventional *B. napus* meal for broiler chickens. There are limited published reports on the nutritive value of meals derived from yellow-seeded canola for turkeys. Jia et al. (2012) determined the $AME_n$ content and the effect of feeding yellow-seeded *B. napus* and *B. juncea* on growth performance and physiological responses in young turkeys (30 d of age). Zdunczyk et al. (2013) investigated the physiological response of the gastrointestinal tract of growing turkeys to diets containing different levels of black-seeded *B. napus* CM. However, the effect of feeding meals derived from yellow-seeded *B. napus* and *B. juncea* on the growth and physiological responses of growing turkeys has not been investigated. Canola meal contains non-starch polysaccharides (**NSP**) which are mainly cellulose, pectic polysaccharides and a variety of other non-cellulosic polysaccharides including xylans, xyloglucans, arabinans, arabinogalactans, or galactomannans (Slominski and Campbell 1990; Bach Knudsen, 1997). Poultry do not express endogenous enzymes capable of digesting NSP, therefore, including a multi-carbohydrase enzyme in their diets can increase the utilization of the various fibre fractions in CM. In earlier studies, enzyme supplementation improved the $AME_n$ content and feed conversion ratio of yellow-seeded canola meal for broiler chickens with a more pronounced effect observed for *B. juncea* meal than the black- and yellow-seeded *B. napus* (Jia et al., 2012; Radfar et al., 2017; Rad-Spice et al., 2017). Little is known about the effect of a new generation of multi-carbohydrase enzymes which contain enzyme activities specifically developed to target various NSP components of CM on its nutrient utilization and growth performance, with the associated changes in gut physiology, for turkeys.

The current study was therefore conducted to evaluate the nutritive value of meals derived from black- and yellow-seeded *B. napus* canola and canola-quality yellow-seeded *B. juncea* for growing turkeys as well as their growth and physiological responses to the different CM types with or without a multi-carbohydrase enzyme supplementation.

It is noteworthy in this research, that the new canola meals that were evaluated were processed under industry commercial processing conditions which yielded the exact type of CM that would be used and fed to poultry in commercial diets. Therefore, it was different from most previous studies of this type using laboratory or research processing facilities, which would likely yield meals that are different than those produced and fed commercially.

## 2. Materials and methods

### 2.1. Plant material and animal care

Large quantities of seeds of black-seeded *B. napus* canola and canola type yellow-seeded *B. juncea*, and yellow-seeded *B. napus* were produced and crushed at Bunge Canola Processing Plant, Altona, Manitoba, Canada and the POS Plant in Saskatoon,

**Table 1**
Chemical composition of *B. napus* and *B. juncea* meals used in the study (g/kg DM).

| Component | *B. napus*, black | | *B. napus*, yellow | *B. juncea*, yellow |
|---|---|---|---|---|
| | Canada | Poland | | |
| Crude protein | 411.4 | 395.1 | 434.0 | 472.0 |
| Ether extract | 51.3 | 20.2 | 34.6 | 39.8 |
| Carbohydrates | | | | |
| Simple sugars | 3.1 | 5.4 | 2.2 | 2.8 |
| Sucrose | 66.1 | 75.0 | 100.5 | 79.7 |
| Oligosaccharides[a] | 31.4 | 24.5 | 28.1 | 31.4 |
| Fibre fractions | | | | |
| Acid Detergent Fibre (ADF) | 200.7 | 224.6 | 93.4 | 99.4 |
| Neutral Detergent Fibre (NDF) | 252.2 | 305.4 | 189.8 | 185.4 |
| Non-starch polysaccharides (NSP) | 217.5 | 192.2 | 228.1 | 204.1 |
| Total dietary fibre | 350.1 | 368.4 | 298.1 | 288.9 |
| Glucosinolates (μmol/g)[b] | 7.9 | 4.9 | 14.6 | 12.5 |

[a] Includes raffinose and stachyose.
[b] Includes gluconapin, glucobrassicanapin, progoitrin, gluconapoleiferin, glucobrassicin and 4-hydroxy-glucobrassicin.