Effect of dietary *Auricularia cornea* culture supplementation on growth performance, serum biochemistry profile and meat quality in growing-finishing pigs

X. Liu¹, Y. Ju², M. Liu³, L. Huang¹, Y. Luo¹, L. Qi¹, J. Ye¹, S. Zhang⁴, Y. Yan¹,⁶ and Y. Li⁵

¹ Guangxi Academy of Agricultural Sciences, Institute of Microbiology, Nanning, 530007, China
² Guangxi Academy of Agricultural Sciences, Guangxi Crop Genetic Improvement and Biotechnology Laboratory, Nanning, 530007, China
³ Lishu Blackland Healthy Food Co., Ltd., Siping, 136599, China
⁴ China Agricultural University, State Key Laboratory of Animal Nutrition, Ministry of Agriculture Feed Industry Centre, Beijing, 100193, China
⁵ Jilin Agricultural University, Engineering Research Center of Chinese Ministry of Education for Edible and Medicinal Fungi, Institute of Mycology, Changchun 130118, China

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ABSTRACT. *Auricularia cornea* culture (ACC) is a dried product containing *Auricularia cornea* (AC) mycelium and various metabolites of AC fermentation. The objective of this study was to investigate the effects of dietary ACC supplementation on growth performance, short-chain fatty acid concentration in faeces, serum biochemical profile and meat quality in growing-finishing pigs. In total, 96 growing pigs with initial body weight 91.94 ± 7.59 kg, were allotted to one of four dietary treatments for 45 days. Treatments were: basal diet and three experimental diets with 0.3, 0.6 and 1.2% ACC addition, respectively. It was shown that pigs fed ACC diets had a greater average daily gain (*P* < 0.05), and also lower glucose content in serum (*P* < 0.05). In comparison with control animals, in pigs fed diets with ACC an increased butyrate content (*P* < 0.05) in faeces and greater monocarboxylate transporter 1 (MCT1) mRNA expression (*P* < 0.05) in the colon were noted. There was also observed an increasing trend concerning *a*² value (*P* = 0.09) and the higher polyunsaturated fatty acid contents in longissimus dorsi muscle (*P* = 0.01). In conclusion, the dietary ACC addition could improve the growth and health of animals as well as meat quality to a certain degree. So, a 1.2% ACC supplementation can be recommended for growing-finishing pigs.

Introduction

As a kind of edible and medicinal fungi, *Auricularia* mushrooms have been widely consumed all around the world. As the fourth most produced mushroom genera, *Auricularia* has been collected, cultivated and consumed in many countries, such as China, Japan, Vietnam and New Zealand, for hundreds of years (Bandara et al., 2015). Mounting studies have revealed a wide range of pharmacological functions of *Auricularia* and their derivatives. *Auricularia* polysaccharides (AP) have been considered to be the major bioactive component, and growing evidences have identified the biological functions of AP with molecular weight (MW) ranging from 4.6 to 3400 kDa, including...
antioxidant, immunomodulatory, hepatoprotective and antitumour activities (Miao et al., 2020).

Both crude AP and water-soluble AP were reported to be able to increase the superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) activities and down-regulate levels of malondialdehyde (MDA) induced by D-galactose in aging mice (Wu et al., 2010; Zhang et al., 2011). Auricularia polysaccharides with MW of less than 110 kDa could stimulate macrophage to secrete interleukin (IL)-1β and IL-6 (Yu et al., 2009). Two kinds of AP (exopolysaccharides) could promote the release of cytokines (IL-6, IL-10 and tumour necrosis factor (TNF)-α) and nitric oxide (NO) in RAW 264.7 cells line (Zhang et al., 2018). A water-soluble AP extracted by hot water could significantly decrease the levels of low-density lipoprotein cholesterol, triglyceride and total cholesterol in the high-fat diet-induced hyperlipidemic mice (Zeng et al., 2013).

β-glucan is a sort of functional polysaccharide that widely spreads in the cell wall of bacterial, fungi and cereal seeds (rye, oats and barley, etc.). It possesses various biological functions such as immune function promotion, glucose regulation and anti-infection (Luo et al., 2019). β-glucan is an important polysaccharide present in mushrooms. Many studies have reported the biological activities of β-glucan (derived from mushroom), including anti-oxidative, immunomodulatory (Nandi et al., 2014) and anti-inflammatory ones (Ruthes et al., 2013). Most of mushroom β-glucan was insoluble, with occurrence percentage ranging from 54 to 82%, whereas the percentage of soluble β-glucan was between 16–46% (Gern et al., 2008). Several researches indicated that β-glucan could promote the growth of rats (Belobrajdic et al., 2015) and pigs (Lee et al., 2017), which was concerned with the effects of improving immunity and promoting intestinal health.

Currently, no information regarding the use of Auricularia cornea culture (ACC) and the associated effects on growth and meat quality are available. In this study, we hypothesized that ACC could be utilized as a feed additive that may benefit the growth and health of growing-finishing pigs. Therefore, the objective of this study was to evaluate the effects of dietary ACC inclusion at different levels (0.3, 0.6 or 1.2%) on growth performance, serum biochemical profile, faecal short-chain fatty acid (SCFA) contents, carcass characteristics and meat quality in finishing pigs.

Material and methods

All procedures involving animal handling received the approval of the Institutional Animal Care and Use Committee of Guangxi Academy of Agricultural Sciences (no. GAAS21011201).

Auricularia cornea culture contained a combination of mycelium and fermentation metabolites produced during the specific fermentation process. The mycelium is mainly composed of protein, chitin, cellulose, etc. (Haneef et al., 2017). Firstly, the Auricularia cornea (AC) strain was inoculated into a 1-m³ stainless-steel fermentation tank under aseptic conditions. After a 7-day liquid fermentation, the inoculum was used for further solid-state fermentation (SSF). During the 15-day SSF, a specific culture media was inoculated with AC strain and allowed to ferment under sterile, temperature-humidity controlled conditions (26 °C). The entire fermented culture media was subsequently dried at a low temperature (55 °C) to preserve the bioactivity. As AC strain fermented proteins and carbohydrates are present in culture media, they could produce a wide variety of metabolic products, including amino acids, peptides and polysaccharides, such as β-glucan (Mukhopadhyay and Guha, 2015; Osińska-Jaroszuk et al., 2021), and several undefined metabolites that may have beneficial effects for pigs. The nutrient content of ACC is shown in Table 1.

Animals, experimental design and sample collection

In total, 96 growing-finishing pigs (Duroc × Landrace × Yorkshire, 91.94 ± 7.59 kg of body weight) were randomly allotted to 4 treatments with 6 replicated pens per treatment (4 pigs per each
pen), including (1) maize-soybean meal basal diet (control diet); (2) control diet supplemented with 0.3% ACC; (3) control diet supplemented with 0.6% ACC; and (4) control diet supplemented with 1.2% ACC (Table 2). The experiment lasted for 45 days, including 2 phases: the grower phase (days 1–23, 100–135 kg) and the finisher phase (days 24–45, 75–100 kg). At the end of the trial, a total of 24 pigs (one pig per pen) were selected with BW close to the average BW of each pen. After 18-h fasting, selected pigs were euthanized by exsanguination. About 200 g of longissimus dorsi muscle (LDM) on the right half of each carcass between the 10th and 12th ribs were acquired for further assessment. The tissue samples from the colon were taken and immediately stored at −80 °C until further mRNA expression analysis. At the end of the trial, a total of 24 pigs (one pig per pen) were selected with BW close to the average BW of each pen. After 18-h fasting, selected pigs were euthanized by exsanguination. About 200 g of longissimus dorsi muscle (LDM) on the right half of each carcass between the 10th and 12th ribs were acquired for further assessment. The tissue samples from the colon were taken and immediately stored at −80 °C until further mRNA expression analysis.

### Table 2. Ingredients and calculated nutrient levels of experimental diets, %, as-fed basis

| Ingredients                  | Grower groups | Finisher groups |
|------------------------------|---------------|-----------------|
|                              | Control       | 0.3% ACC       | 0.6% ACC       | 1.2% ACC       | Control       | 0.3% ACC       | 0.6% ACC       | 1.2% ACC       |
|                              | 0.88          | 15.87          | 4.33           | 0.90           | 77.91         | 77.91          | 77.91          | 5.40           |
|                              | 13.00         | 14.23          | 16.22          | 0.61           | 13.00         | 13.00          | 13.00          | 4.80           |
|                              | 0.73          | 0.72           | 0.72           | 0.72           | 0.60          | 0.30           | 0.30           | 1.20           |
|                             | 0.50          | 0.50           | 0.50           | 0.50           | 0.50          | 0.50           | 0.50           | 0.50           |
|                             | 0.73          | 0.73           | 0.73           | 0.73           | 0.60          | 0.60           | 0.60           | 0.60           |
|                             | 0.60          | 0.60           | 0.60           | 0.60           | 0.60          | 0.60           | 0.60           | 0.60           |
|                             | 0.27          | 0.27           | 0.27           | 0.27           | 0.27          | 0.27           | 0.27           | 0.27           |
|                             | 0.01          | 0.01           | 0.01           | 0.01           | 0.01          | 0.01           | 0.01           | 0.01           |
|                             | 0.50          | 0.50           | 0.50           | 0.50           | 0.50          | 0.50           | 0.50           | 0.50           |

**ACC** – *Auricularia cornea* culture, **DE** – digestible energy, **SID** – standardized ileal digestible, **Lys** – lysine, **Met** – methionine, **Thr** – threonine, **Trp** – tryptophan; ^1^ provided the following per kg of complete diet: IU: vitamin A 5512, vitamin E 30, vitamin D₃, 2200; μg: vitamin B₁₂, 27.6, biotin 44; mg: vitamin K₃, 2.2, D-pantothenic acid 14, pyridoxine 3, riboflavin 4, folic acid 0.7, thiamine 1.5, Mn 40, Cu 100, Fe 75, Mn 120, Zn 75, I 0.35, Se 0.3

### Chemical analysis

The ACC powder, diets and faeces were analysed for crude protein (CP), dry matter (DM), ash, ether extract (EE), calcium and total phosphorus (AOAC International, 2006). The gross energy (GE) was detected by an Automatic Isoperibol Oxygen Bomb Calorimeter (C2000, IKA, Staufen, Germany). The concentrations of acid detergent fibre (ADF) and neutral detergent fibre (NDF) were measured by a fibre analyser equipment (2010, FOSS, Hillerød, Denmark) (Van Soest et al., 1997). The SCFA contents were measured via an ion chromatography (883, Metrohm, Herisau, Switzerland) according to the procedure described by...
Wu et al. (2017). Antioxidant parameters, including total antioxidant capacity (T-AOC), superoxide dismutase (SOD) activity, glutathione peroxidase (GSH-Px) activity and malondialdehyde (MDA) content were analysed by assay kits purchased from Jiancheng Bioengineering Ltd. (Nanjing, China). The concentrations of IL-1β, IL-2, IL-6, TNF-α were measured using ELISA kits (Jiancheng Bioengineering Ltd., Nanjing, China) with an ELISA Reader (Multiskan, Thermo Fisher Scientific, Waltham, MA, USA). The contents of low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglyceride (TG), total cholesterol (TC), glucose (GLU) in serum were analysed by an automatic biochemical analyser (3100, Hitachi, Tokyo, Japan) using corresponding kits (Jiancheng Bioengineering Ltd., Nanjing, China). Fatty acids contents were analysed by gas chromatography (6890, Agilent Technologies, Inc., Santa Clara, CA, USA) according to Sukhija and Palmquist (1988).

Carcass traits and meat quality determination

After slaughtering, pigs were weighed individually to calculate the hot carcass weight, then were chilled at 4 °C to measure the carcass length, backfat thickness, loin eye area and marbling. Meat quality assessment, including pH value, meat colour, cooling loss, shear force and drip loss, were subsequently proceeded.

The dressing percentage was calculated according to the following equation: dressing percentage (%) = 100 × carcass weight / live body weight. Carcass length was calculated between the 1st rib and the public bone (Latorre et al., 2009). The backfat thickness and loin eye area were determined at the 10th rib according to the procedure described by the Chinese Guidelines on Performance Measurement Technology and Regulations for pig (Ministry of Agriculture of the People’s Republic of China, 2014). Three points of the 1st rib, last rib and last lumbar vertebra were recorded to determine the backfat thickness by a vernier caliper. The loin eye area was calculated according to the equation: loin eye area (cm²) = loin eye width (cm) × loin eye height (cm) × 0.7. Marbling was evaluated according to the National Pork Producers Council (NPPC) of the United States guidelines (NPPC, 1999).

After making an incision on the LDM, the muscle pH value was measured using a glass penetration pH electrode (IS400, SP, AL, USA) at 45 min post-mortem and recorded as pH 24 h. Then, the drip loss was calculated as: drip loss (%) = the amount of drip (g) / initial meat weight (g).

Table 3. Primer sequences for Real-Time polymerase chain reaction analysis

| Gene | Primer | Sequence (5’—3’) |
|------|--------|-----------------|
| MCT1 | Forward | GGAGACCAGTATAGACGCTGC |
|      | Reverse | CTCTCTCTTGGGGCTTC |
| ACTB | Forward | TGGGGAGATCCAAGGAGAAGC |
|      | Reverse | ACAGACCGTGTTGGCGTAGAG |

MCT1 – monocarboxylate transporter 1; ACTB – β-actin

The Real-Time polymerase chain reaction (PCR) was performed in a total volume of 10 µl, which contained 0.2 µl each of forward and reverse primers, 1 µl cDNA template, 0.2 µl ROX Reference Dye and 5 µl SYBR Green mix. Then, the Real-Time quantitative PCR was performed with general cycling...
conditions as follows: pre-denaturation at 95 °C for 10 s; 40 cycles of amplification at 95 °C for 5 s and 60 °C for 20 s; melting curve construction from 60 °C to 99 °C with a heating rate of 0.1 °C/s and fluorescence measurements (Applied Biosystems™ 7500 Real-Time PCR System; Thermo Fisher Scientific, Waltham, MA, USA).

### Statistical analysis

The data for growth performance, biochemical indices, carcass traits and meat quality were analysed by analysis of variance (ANOVA) using the PROC GLM procedure of SAS (version 9.2, SAS Institute Inc., Cary, NC, USA) followed by Student-Newman-Keuls multiple range tests. The significances were estimated at a probability level of 0.05.

### Results

As shown in Table 4, there was a trend ($P = 0.07$) concerning final BW of pigs fed ACC diets. No effects were observed on ADG, ADFI and F/G ratio during days 1–23. Pigs fed ACC diets showed a higher ADG ($P \leq 0.01$), whereas ADFI and F/G ratio were not influenced during days 24–45 and the overall period.

| Days 1 to 23 | ADG, g | 904 | 906 | 908 | 910 | 4.24 | 0.73 |
|-------------|--------|-----|-----|-----|-----|-------|-----|
| ADFI, g     | 2450   | 2392| 2437| 2460|     | 53.51 | 0.82 |
| F/G         | 2.71   | 2.64| 2.68| 2.70|     | 0.06 | 0.84 |

| Days 24 to 45 | ADG, g | 828<sup>a</sup> | 840<sup>b</sup> | 849<sup>c</sup> | 853<sup>c</sup> | 4.35 | <0.01 |
|---------------|--------|-----------------|-----------------|-----------------|-------|-------|------|
| ADFI, g       | 2525   | 2514            | 2558            | 2578            |     | 26.07 | 0.32 |
| F/G           | 3.05   | 2.99            | 3.01            | 3.02            | 0.03 | 0.69  |      |

| Days 1 to 45  | ADG, g | 867<sup>a</sup> | 874<sup>b</sup> | 880<sup>c</sup> | 882<sup>c</sup> | 3.00 | 0.01 |
|---------------|--------|-----------------|-----------------|-----------------|-------|-------|------|
| ADFI, g       | 2486   | 2452            | 2496            | 2517            |     | 34.02 | 0.60 |
| F/G           | 2.87   | 2.81            | 2.84            | 2.85            | 0.04 | 0.72  |      |

According to obtained data (Table 5), dietary ACC supplementation showed no effects on SCFAs contents on day 23. Dietary 1.2% ACC supplementation in diets increased the butyrate content ($P = 0.03$) in pig faeces on day 45.

| Day 23 | acetate | 4256.34 | 4178.04 | 4226.06 | 4469.30 | 222.47 | 0.80 |
|--------|---------|---------|---------|---------|---------|---------|------|
| propionate | 3319.74 | 3307.82 | 3057.96 | 3242.03 | 125.71 | 0.52  |      |
| butyrate | 488.09  | 476.59  | 496.56  | 484.38  | 19.70  | 0.91  |      |
| total    | 8064.16 | 8025.45 | 8230.58 | 8195.72 | 255.92 | 0.93  |      |

In pigs fed 1.2% ACC a greater MCT1 mRNA expression ($P = 0.01$) in colon was observed (Figure 1).

As shown in Table 6, in comparison with control animals, pigs fed ACC diets revealed reduced glucose content ($P = 0.03$), and there was no significant effect on GSH-Px, T-AOC, SOD and the other serum indices.

In terms of meat quality (Table 7), there was an increased trend on a* value ($P = 0.09$). No differences in carcass weight, loin eye area, marbling, shear force, drip loss, and pH values were observed in pigs fed ACC diets in comparison with control ones.

As shown in Table 8, in pigs fed 0.6 and 1.2% ACC diets greater linoleic acid ($P = 0.02$) and arachidonic acid ($P < 0.01$) contents were noted in comparison with control ones. Diets supplemented with ACC significantly increase the sums of polyunsaturated fatty acids (PUFA) ($P = 0.01$) and sums of n-6 PUFA ($P < 0.01$) in the LDM.
Table 6. Effects of dietary *Auricularia cornea* culture (ACC) supplementation on serum profile of pigs

| Indices                        | Treatments | Control | 0.3% ACC | 0.6% ACC | 1.2% ACC | SEM | P-value |
|-------------------------------|------------|---------|----------|----------|----------|-----|---------|
| Day 45                        |            |         |          |          |          |     |         |
| GSH-Px, U/ml                  | 1109.25    | 1070.67 | 1053.27  | 1122.16  | 41.86    | 0.63|         |
| T-AOC, U/ml                   | 13.43      | 14.66   | 14.72    | 14.94    | 0.80     | 0.55|         |
| SOD, U/ml                     | 75.06      | 82.21   | 79.28    | 80.62    | 4.79     | 0.75|         |
| MDA, nmol/ml                  | 2.65       | 2.39    | 2.76     | 2.58     | 0.24     | 0.73|         |
| HDL-C, mmol/l                 | 1.02       | 1.07    | 1.16     | 1.14     | 0.09     | 0.65|         |
| LDL-C, mmol/l                 | 1.31       | 1.10    | 1.24     | 1.21     | 0.14     | 0.76|         |
| TC, mmol/l                    | 2.49       | 2.67    | 2.41     | 2.52     | 0.19     | 0.80|         |
| TG, mmol/l                    | 0.56       | 0.61    | 0.64     | 0.55     | 0.08     | 0.83|         |
| GLU, mmol/l                   | 2.96±a     | 2.81±a  | 2.89±a   | 2.69±b   | 0.06     | 0.03|         |
| IL-1β, pg/l                   | 27.21      | 27.48   | 26.84    | 26.52    | 1.81     | 0.98|         |
| IL-2, ng/l                    | 488.20     | 476.24  | 493.39   | 496.77   | 12.78    | 0.70|         |
| IL-6, pg/l                    | 90.94      | 88.70   | 93.22    | 89.38    | 4.69     | 0.91|         |
| TNF-α, ng/l                   | 206.56     | 216.00  | 202.58   | 218.54   | 9.52     | 0.60|         |

n = 6; SEM = standard error of the mean; GSH-Px – glutathione peroxidase, T-AOC – total antioxidant capacity, SOD – superoxide dismutase, MDA – malondialdehyde, HDL-C – high-density lipoprotein cholesterol, LDL-C – low-density lipoprotein cholesterol, TC – total cholesterol, TG – triglyceride, GLU – glucose, IL-1β – interleukin-1β, IL-2 – interleukin-2, IL-6 – interleukin-6. TNF-α – tumour necrosis factor-α; ± – means with different superscripts are significantly different at P < 0.05

Table 7. Effects of dietary *Auricularia cornea* culture (ACC) supplementation on carcass traits and meat quality of pigs

| Indices                     | Treatments | Control | 0.3% ACC | 0.6% ACC | 1.2% ACC | SEM | P-value |
|-----------------------------|------------|---------|----------|----------|----------|-----|---------|
| Carcass traits              |            |         |          |          |          |     |         |
| carcass length, cm          | 106.20     | 105.43  | 106.08   | 106.18   | 1.07     | 0.95|         |
| hot carcass weight, kg       | 98.55      | 97.35   | 99.28    | 98.15    | 1.81     | 0.90|         |
| dressing percentage, %      | 74.78      | 74.14   | 75.73    | 74.99    | 0.56     | 0.24|         |
| loin eye area, cm²           | 42.97      | 43.77   | 46.34    | 46.97    | 2.12     | 0.49|         |
| backfat thickness            | 14.83      | 14.5    | 14.17    | 14.67    | 0.64     | 0.86|         |
| marbling                    | 1.75       | 1.67    | 1.92     | 2.00     | 0.23     | 0.74|         |
| Meat quality                 |            |         |          |          |          |     |         |
| cooling loss, %              | 21.50      | 21.53   | 22.89    | 21.82    | 0.89     | 0.66|         |
| shear force, kg              | 33.86      | 32.35   | 33.72    | 32.53    | 1.42     | 0.80|         |
| drip loss, %                 | 2.25       | 1.54    | 1.76     | 1.93     | 0.2       | 0.12|         |
| L* (45 min)                  | 35.62      | 36.15   | 37.06    | 37.38    | 0.57     | 0.15|         |
| a* (45 min)                  | 3.83       | 3.96    | 4.13     | 4.25     | 0.12     | 0.11|         |
| b* (45 min)                  | 3.55       | 3.76    | 3.46     | 3.52     | 0.17     | 0.62|         |
| L* (24 h)                    | 55.58      | 55.16   | 55.2     | 55.98    | 1.18     | 0.95|         |
| a* (24 h)                    | 10.27      | 10.87   | 11.56    | 11.21    | 0.34     | 0.09|         |
| b* (24 h)                    | 7.51       | 7.36    | 7.82     | 7.92     | 0.37     | 0.69|         |
| pH45 min                     | 6.72       | 6.46    | 6.27     | 6.31     | 0.14     | 0.13|         |
| pH45h                        | 5.91       | 5.87    | 5.78     | 5.82     | 0.09     | 0.74|         |

pH45min – pH value 45 min after post-mortem, pH45h – pH value 24 h after post-mortem, L*, a*, b* (45 min) – meat colour values 45 min after post-mortem, L*, a*, b* (24 h) – meat colour values 24 h after post-mortem. SEM – standard error of the mean; values are means with pooled SEM, n = 6

The concentrations of saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA) were not influenced by dietary ACC supplementation. The dihydro-γ-linolenic content (P = 0.08) and PUFA/SFA ratio value (P = 0.09) tended to improve in pigs fed ACC diets.

**Discussion**

Polysaccharides are the main component (about 90%) of the AC cell wall, and the β-glucan is the central core of the cell wall (Osińska-Jaroszuk et al., 2021). The β-glucan concentration in mushrooms ranged from 0.21 to 0.53 g/100 g (dry weight
basis) (Rop et al., 2009). It was revealed that the ACC supplementation effectively improve the ADG in pigs. The ameliorated effect might derive from the nutraceutical compounds in ACC. The increased ADG possibly due to the intestinal improvement, as Metzler-Zebeli et al. (2012) indicated that dietary β-glucan could modulate the morphology of piglets and improve intestinal structure. This result is consistent with the previous studies, as Luo et al. (2019) showed that diet supplemented with β-glucan (100 mg/kg) might significantly increase ADG and feed conversion ratio, and 0.025% β-glucan addition has been shown to augment ADG and ADFI in piglets (Dritz et al., 1995). Li et al. (2006) and Vetvicka et al. (2014) also concluded that supplementing diets with β-glucan could improve pig health and growth performance.

Pigs fed ACC revealed a higher butyrate level in the current study. The reason was highly due to the β-glucan proportion, which could act as a unique substrate for the SCFA-generated microbes and modify the relative composition of intestinal microbiota. The mammalian genome does not encode most enzymes required to degrade β-glucan, and β-glucan could escape digestion in the foregut and be fermented in the hindgut, resulting in improving SCFA production that altered the microbial ecology in the gastrointestinal tract of pigs. Pieper et al. (2012) reported that feeding β-glucan enhanced the contents of lactate and propionate in the colon of piglets. Metzler-Zebeli et al. (2012) also showed that oat β-glucan enhanced caecal and colonic butyrate contents, which could be favourable for intestine development in weaned piglets.

Butyrate is the principal energy source for colonic epithelial cells, which plays a vital role in the epithelial maintenance of intestinal barrier function. The butyrate transportation across the colonoocyte luminal membrane is mediated by the MCT1 (Cuff et al., 2002; Plöger et al., 2012). The increased butyrate from the fermented carbohydrates by probiotics has improved MCT1 expression in pigs (Metzler-Zebeli et al., 2012). The carrier-mediated butyrate absorption from the hindgut lumen could be also through MCT1 expression (Tudela et al., 2015). Borthakur et al. (2008) reported that butyrate could activate the MCT1 expression that might occur through a butyrate response element in the MCT1 gene promoter region. To further explore the mechanisms involved in the improving effect, we determined the colonic MCT1 mRNA expression, as the generation of butyrate has been positively related to the MCT1 pathway (Cuff et al., 2002). The result showed that 1.2% ACC supplementation could up-regulate the expression of MCT1 in the colon. The MCT1 mRNA expression and activity were regulated by butyrate, as Cuff et al. (2002) indicated that butyrate presented a concentration- and time-dependent relationship of both MCT1 protein and mRNA. The result is in accordance with the study of Metzler-Zebeli et al. (2012), who showed that dietary β-glucan could up-regulate MCT1 expression in the caecum. Tudela et al. (2015) investigated the influence of bacterial metabolites on MCT1 expression, and showed that MCT1 expression was higher after incubation with Na-butyrate.

The ACC contains multifarious nutritive materials, especially the polysaccharide from AC, which show various pharmacological activities (Wang et al., 2019). Based on the experimental result, the ACC exhibited a hypoglycemic effect, which was consistent with the study of Wang et al. (2019). In the opinion of Wang et al. (2019), AC appears to impact glucose metabolism mainly by altering phosphoenolpyruvate carboxykinase (PEPCK) and glucose-6-phosphatase (G-6-Pase) levels in mice’s liver. The inhibition of PEPCK and G-6-Pase may effectively regulate blood glucose improvement (Cui et al., 2018). Meat colour was a vital indicator for the assessment of pork appearance. It was influenced by several factors, such as intramuscular fat content, postmortem glycolysis rate, pigment level and oxidative status of pigment (Van Oeckel et al., 1999). We have revealed that under ACC supplementation a* value had a trend towards increase, which was in accordance with the study in which yeast polysaccharide improved the meat colour (redness had a trend to increase) (Ma et al., 2017). Researches indicated that β-glucan supplementation could increase a* value of pork and chicken meat (Cho et al., 2013; Luo et al., 2019). The underlying reason for the redder meat colour of β-glucan-treated pigs might be attributed to an increased mean fibre cross-sectional area or the increased fast twitch muscle fibres (Petersen et al., 1998; Luo et al., 2019).

The fatty acid profile is a valuable parameter of meat quality. The fatty acid profile is the important physical base of meat flavour and has been a primary area of consumer concern (Luo et al., 2019). The present study showed that the proportions of linoleic acid, arachidonic acid, total PUFA and n-6 PUFA in pigs fed 1.2% ACC diet were increased, in comparison with control animals. Fatty acids are the main components of adipose tissue, the PUFA could only be acquired from diets, as n-3 and n-6 PUFA could not be converted into each other (Liu et al., 2020). To our knowledge, there is limited available literature about dietary AC addition and its relation to the pork fatty acid profile. The result was
probably analogue with previous studies that showed two types of fungi, *Aspergillus* and *Saccharomyces*, could improve the UFA/SFA ratio and linolenic acid content in broiler meat through its beneficial effects on the intestinal microbiota (Endo and Nakano, 1999; Saleh et al., 2013). Polyunsaturated fatty acids compose more than one unsaturation and are beneficial to health. The n-3 and n-6 PUFAs are necessary for the body and have specific functions, namely anti-inflammatory, vasodilatory and chemotactic effects (Kus-Yamashita et al., 2016). Linoleic acid plays a positive role in reducing blood cholesterol and slowing the development of atherosclerosis (Jandacek, 2017). Arachidonic acid is a fundamental constituent of cell structure and is an essential fatty acid for animals. It impacts the function of specific membrane proteins and plays a vital role in maintaining the integrity of cells and organelle (Tallima and Ridi, 2017). Thus, dietary ACC supplementation could improve PUFA contents in LDM, which is beneficial for human consumption and health. However, the reasons for the changes in the fatty acid composition affected by ACC supplementation are unclear in the current study, so further research is necessary to determine the possible mechanism of such situation.

**Conclusions**

The supplementation of *Auricularia cornea* culture (ACC) to pig diets could improve growth performance, faecal short-chain fatty acid content, polyunsaturated fatty acid contents in *longissimus dorsi* muscle, and showed a hypoglycemic effect to a certain degree. So, the optimal supplementation of 1.2% ACC into growing-finishing pig diets may be recommended.

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**Conflict of interest**

The authors declared that there is no conflict of interest.

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