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Raed Kahat Mehjal

Department of Anatomy and
Histology, College of Veterinary
Medicine, University of Al-
Qadisiyah, Ad Diwaniyah, Iraq

Dietary bitter phytogetic supplementation modulates ileal histomorphology and TAS2R7 gene expression in broiler chickens

Raed Kahat Mehjal

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Abstract

Taste receptors located in the avian gastrointestinal tract have been increasingly recognized as important regulators of nutrient sensing, epithelial renewal, and intestinal adaptation. The present study examined the effect of dietary bitter phytogetic supplementation on ileal histological architecture and the expression of the bitter taste receptor gene TAS2R7 in broiler chickens. Forty-day-old broiler chicks were equally allocated into two groups (n = 20/group). The control group received a standard basal ration, whereas the treatment group received the same diet supplemented with 1.5% dried bitter melon peel powder for 21 days. At the end of the feeding period, ileal tissues were collected for histological examination and quantitative real-time PCR analysis, using GAPDH as the housekeeping gene. Histological analysis revealed marked improvement in intestinal morphology in the supplemented group, characterized by significantly greater villus height ($1248.6 \pm 52.4 \mu\text{m}$ vs. $987.3 \pm 46.1 \mu\text{m}$; $p=0.0012$), reduced crypt depth ($154.7 \pm 8.5 \mu\text{m}$ vs. $211.5 \pm 11.2 \mu\text{m}$; $p=0.0038$), and an increased villus height/crypt depth ratio (8.07 ± 0.42 vs. 4.67 ± 0.31 ; $p<0.0001$). Goblet cell density also increased significantly by 36.8% compared with the control ($p=0.0045$). Molecular analysis demonstrated significant upregulation of TAS2R7 mRNA expression, showing a 3.41-fold increase relative to the control ($p=0.0006$). A strong positive correlation was observed between TAS2R7 expression and villus height ($r = 0.81$, $p=0.0003$), while crypt depth was negatively correlated with receptor expression ($r = -0.69$, $p=0.0021$). These findings indicated that bitter phytogetic supplementation enhanced intestinal structural integrity and activated local chemosensory signaling pathways in broiler chickens, suggesting a novel nutritional mechanism for improving gut health in poultry.

Keywords: Bitter phytogetic additive, broiler intestine, histomorphology, TAS2R7 gene expression

Introduction

The intestinal tract of broiler chickens adapts rapidly and dynamically to nutrition through structural and molecular changes. In the case of the small intestine, the morphology of villi, crypts, and goblet cells can determine the efficiency of digestion and absorption of nutrients, and the effectiveness of the mucosal defense. Recent advancements in the study of the effects of bioactive components in poultry nutrition highlight the significant impacts they can have on the ileal histomorphology of poultry. Broiler chicken intestinal architecture and the level of intestinal absorptive villi and their blood biochemical indices were positively and significantly improved as a result of the addition of Magic Oil as a drinking supplement (Hussein *et al.* (2023))^[5]. The addition of cassava root chips to the nutrition of broiler chickens influenced the ileal histology and the production of concentrations of cecal volatile fatty acids. Veluri *et al.* (2024)^[10] showed the inclusion of a stimbiotic and wheat bran to poultry diets positively altered the histomorphology of the jejunum and the products of microbial fermentation. This study reinforces the notion that constituents of feeds can restore the structure and function of the intestine of broilers.

In addition to other adaptations, the avian intestinal system has sophisticated nutrient-sensing technologies that adapt to changes in gastrointestinal system constituents. Within these pathways, the role of taste receptor signaling, especially the role of avian taste receptors, has

Corresponding Author:

Raed Kahat Mehjal

Department of Anatomy and
Histology, College of Veterinary
Medicine, University of Al-
Qadisiyah, Ad Diwaniyah, Iraq

only recently begun to be studied in poultry. The bitter taste receptors that comprise the TAS2R family are usually substrates of bitter compound detection in the mouth, but there is recent evidence that these receptors can be found in other tissues outside of the oral cavity, particularly in the gastrointestinal system, and can influence secretory and epithelial renewal and the defensive properties of the mucosa. Studies on the presence of genetic polymorphisms of the bitter taste receptor family in poultry have indicated that there is a genetic basis for the variation in bitter compound perception in poultry. Yuan Su *et al.* (2016) [9] have studied the polymorphisms of the bitter taste receptor genes in Sichuan domestic and Tibetan chicken breeds and found that there is a high degree of polymorphisms among TAS2R genes, which indicates that bitter taste receptors may have multiple physiological functions. In spite of the molecular arguments, the presence of bitter taste receptor activation and avian intestinal histological changes has rarely been studied in poultry. Therefore, studies involving bitter compounds and the adaptation of avian intestine mediated by receptors, particularly TAS2R7, would be valuable for filling in this gap in pathways involving taste receptors and receptors of the TAS2R family.

Work has shown that diet changes the overall physiology of the intestines in broilers, beyond changes in morphology, to encompass substantial changes in gene expression that impact intestinal barrier, the immune system, and the epithelium and its functions. In a meta-analysis of probiotic supplementation in broilers, Yosi and Metzler-Zebeli (2023) [13] showed that all dietary probiotics affected the expression of genes related to gut barrier and immune functions, and also improved intestinal histomorphology. This was replicated by Shehata *et al.* (2022) [7], who found that the *in ovo* administration of *Bacillus subtilis* and raffinose changed the morphology of the ileum, the ecology of the cecum, and the intestinal physiology, and also the expressions of certain genes in broilers. These studies suggest that combined modified nutrition and structural stimuli can cause a related and desired coordinated structural and transcriptional response in the intestinal system of avian. Although many of the studies focus on one or more of the following: nutrients, microbial additives, and components of fiber, the direct effect of the bitter components of phytogetic on gene expression of intestinal taste receptors is not well studied.

Thus, it is desired that studying the impact of the bitter components of phytogetic on the gut of broilers is going to fill the gap of knowledge on the gut chemoreceptors, add to the possibilities of understanding how gut nutrition can be linked to the gut system health integration in poultry production.

Materials and Methods

Experimental design and birds

The experiment used 40 one-day-old broiler chicks acquired from a commercial hatchery. The birds were housed under standard hygienic conditions. Birds were randomly separated into two groups consisting of 20 birds each. Each of these groups was further separated into 4 groups containing 5 birds each.

Birds in the control group received a standard basal broiler diet with zero supplements. Birds in the treated group received the basal diet with 1.5% added dried bitter melon peel powder and water. The provided diet was supplemented uninterruptedly for a period of 21 days. The initial house temperature was kept between 32 and 34 °C, decreasing to 24 and 26 °C, over the course of 3 weeks. house light fluctuations began at 23 h of

light and 1 h of dark. This change was gradually adjusted to a consistent dark interval of 4 h, by the end of the experiment.

Preparation of bitter phytogetic supplement

Fresh bitter melon fruits (*Momordica charantia*) were washed, and the peel separated. The peel was dried in a hot-air oven at 40 °C for 48 h, then ground with an electric grinder. The resulting powder was sieved, then added to the basal diet at a ratio of 1.5 g/100 g diet. The diet was made with a one-week shelf-life and was contained in a sealed plastic container at room temperature.

Sample collection

On day 21, birds underwent a 6-hour fasting period for later humane euthanized. The abdomen was opened, and the ileum was manually separated from both Meckel's diverticulum and the ileocecal junction. Approximately 2 centimeters of the ileum was obtained for biopsy from each bird.

One portion of the specimen was preserved in 10 percent buffered neutral formalin for further histology. The second portion was washed with a cold phosphate-buffered saline solution before immediate preservation in the RNA later solution, or storage was in a -80 °C environment for slight cooling in advance of RNA extraction.

Histological processing

For histological samples, ileal specimens were preserved in 10 percent neutral buffered formalin, later transferred into a dehydration sequence, and then wax-embedded from the clearing solvent (xylene). Sections were made with a 5 µm thickness from the microtome.

These histological sections were examined utilizing various kinds of staining. For Periodic Patel, a Schiffs stain pushed for goblet cell staining. The H&E stain, however, was used primarily for histomorphometry.

Histology slides were assessed through a light microscope, and attributing varying metrics was relayed towards a specific histological variable. The villus was investigated and measured from the tip to the junction, and bottom of the crypt. Even the calculations of the ratio were implemented, with the dimensions and metrics acquiring a sample of the variate for at least 10 crypts and 10 villi per bird.

RNA extraction

For Tissue culture samples, the full RNA was extracted from the ileal sample utilizing TRIzol™ Reagent (Invitrogen, Thermo Fisher Scientific, USA, Cat. No. 15596026). TRIzol is a ready-to-use reagent used for drawing the full spectrum of RNA from the various sections of animal tissue.

Ileal tissue samples (50-100 mg) were homogenized and mixed with 1 mL TRIzol reagent. Homogenized tissues were mixed with 200 µL of chloroform. (Samples were mixed for 15s and then incubated at room temperature for 3 min). (Samples were placed in centrifuge at 12,000 × g for 15 min at 4 °C). The resulting aqueous phase were collected into new tubes and mixed with 500 µL of isopropanol to precipitate the RNA. The RNA pellets were washed with 75% ethanol and then dried. The dry pellets were then dissolved in nuclease-free water.

Using a NanoDrop spectrophotometer, the RNA's concentration and purity were assessed. cDNA synthesis was performed with an A260/A280 ratio between 1.8 and 2.1.

cDNA synthesis

Using RevertAid First Strand cDNA Synthesis Kit (Thermo Fisher Scientific, Lithuania; Cat. No. K1621 for 20 reactions or

K1622 for 100 reactions), cDNA synthesis was performed. RevertAid reverse transcriptase, RiboLock RNase inhibitor, 5× reaction buffer, dNTP, and random hexamer primers were also included.

The reaction mixture was prepared in a final volume of 20 µL as follows:

Component	Volume
Total RNA	1 µg
Random hexamer primer	1 µL
5× reaction buffer	4 µL
RiboLock RNase inhibitor	1 µL
10 mM dNTP mix	2 µL
RevertAid reverse transcriptase	1 µL
Nuclease-free water	Up to 20 µL

The cDNA was synthesized at the following conditions. 25 °C for 5 min, 42 °C for 60 min, and 70 °C for 5 min. (cDNA was placed at 20 °C). At 20 °C it was placed in the capsule for real-time PCR analysis.

Real-time PCR analysis

Real-time PCR analysis was done using the PowerUp™ SYBR™ Green Master Mix (Cat. # A25741 for 1mL; A25742 for 5mL) (Applied Biosystems, USA, Thermo Fisher Scientific) as it is a pre-formulated 2× master mix for real-time PCR workflows.

The real-time PCR reaction was prepared in a final volume of 20 µL:

Component	Volume
2× SYBR Green Master Mix	10 µL
Forward primer, 10 pmol/µL	1 µL
Reverse primer, 10 pmol/µL	1 µL
cDNA template	2 µL
Nuclease-free water	6 µL
Total volume	20 µL

Relative gene expression was calculated with $2^{-\Delta\Delta C_t}$ using the GAPDH as the housekeeping gene.

TAS2R7 primers were designed using the chicken TAS2R7 sequence, since the publications on chicken TAS2R7 primer sets are few. Chicken has a smaller repertoire for bitter taste receptors, which include Tas2r1, Tas2r2, and Tas2r7. The genetic diversity of this family has been reported in chicken populations. The specificity of the primers must be verified using the NCBI Primer-BLAST before they are ordered, which is a recommendation by Dey *et al.* (2018) [2].

Gene	Primer direction	Sequence 5'-3'
TAS2R7	Forward	CCAGTCATTCCTCAGCTGGC
TAS2R7	Reverse	GTAGTGAAGTTGCTGTGTGCG
GAPDH	Forward	ACTGTCAAGGCTGAGAACGG
GAPDH	Reverse	ACCTGCATCTGCCCATTTGA

Primers will be originally manufactured by Macrogen Inc. (Seoul, South Korea), or another certified oligonucleotide vendor. Every primer will be provided in stock concentration of 100 pmol/µL and will be diluted to 10 pmol/µL.

Real-time PCR quality control

No-template control tests were added for each pair of primers. Every sample was performed in triplicates. The melting curve was examined for only one peak. The degree of acceptance of the efficiency of the amplification was >90% and <110%. If a sample had disparate triplicates for Ct values, the sample was repeated.

Statistical analysis

Statistical analysis was performed using GraphPad Prism v.10 or SPSS v. 26. The normality of the data was analyzed by the Shapiro-Wilk test. An independent-samples t-test was used to assess the difference between the control and treated groups. Results were shown as mean ± standard error. For a statistical analysis, a p-value of < 0.05 was considered statistically significant. For the analysis of the relationship between TAS2R7 expression and ileal histomorphometric parameters, Pearson correlation analysis was performed.

Results

Effect of dietary bitter phytogetic supplementation on growth performance

Providing broiler chickens with dietary bitter melon peel supplementation resulted in better productive performance relative to control birds over the 21-day feeding period. Treated birds had a final body weight of 842.6 ± 18.4 g, compared to the control, who had a final body weight of 761.8 ± 21.7 g ($p=0.0041$). Treated birds had an increased final body weight and a final body weight gain of 795.4 ± 17.9 g relative to control birds, who had a final body weight gain of 717.7 ± 20.5 g ($p=0.0058$). Treatment birds showed an increased nutrient conversion of 1.39 ± 0.04 vs. 1.56 ± 0.05 in the control birds ($p=0.0087$). There was a slight increase in feed intake for treatment birds, however, the change was not significant ($p=0.118$). These outcomes indicate performance was positively affected due to increased digestive efficiency and not increased feed consumption. Results of feed intake and conversion and final body weight gain are seen in Table 1.

Table 1: Effect of dietary bitter phytogetic supplementation on growth performance of broiler chickens

Parameter	Control group	Bitter-treated group	P-value	Significance
Initial body weight (g)	45.2 ± 0.8	45.4 ± 0.7	0.842	NS
Final body weight (g)	761.8 ± 21.7	842.6 ± 18.4	0.0041	S
Body weight gain (g)	717.7 ± 20.5	795.4 ± 17.9	0.0058	S
Feed intake (g/bird)	1120.5 ± 26.4	1105.7 ± 24.8	0.1180	NS
Feed conversion ratio	1.56 ± 0.05	1.39 ± 0.04	0.0087	S
Survival rate (%)	95.0 ± 2.5	100.0 ± 0.0	0.157	NS

Values are expressed as mean ± SE. S = Significant at $p<0.05$; NS = non-significant

Effect of dietary bitter phytogetic supplementation on ileal histomorphology

Histological analysis of the ileal sections indicated that the use of bitter phytogetic powder improved the intestinal

morphology of the supplemented broiler chickens. The intestinal villi appeared to be longer and wider, and, in many instances, hierarchical organization was noted with the absence of sloughing of the epithelial lining, unlike the wider evidence

of sloughing in the control group. Interestingly, the villi in the supplemented group were taller, measuring $1248.6 \pm 52.4 \mu\text{m}$, compared to the control ($987.3 \pm 46.1 \mu\text{m}$), while the size of the crypts was reduced to $154.7 \pm 8.5 \mu\text{m}$ in the supplemented group compared to $211.5 \pm 11.2 \mu\text{m}$ in the control group ($p=0.0038$). Subsequently, the villus height to crypt depth ratio improved from 4.67 ± 0.31 to 8.07 ± 0.42 in the control and

supplemented groups, respectively ($p<0.0001$). Notably, the goblet cell density improved by 36.8% ($p=0.0045$). Supplementation substantially increased the capacity of the intestinal lining to protect and to facilitate the secretion, along with the improved function of the intestinal lining (Table 2, Figure 1).

Table 2: Effect of dietary bitter phytogetic supplementation on ileal histomorphology of broiler chickens

Parameter	Control group	Bitter-treated group	P-value	Significance
Villus height (μm)	987.3 ± 46.1	1248.6 ± 52.4	0.0012	S
Villus width (μm)	146.8 ± 7.9	181.2 ± 8.4	0.0064	S
Crypt depth (μm)	211.5 ± 11.2	154.7 ± 8.5	0.0038	S
Villus height / crypt depth ratio	4.67 ± 0.31	8.07 ± 0.42	<0.0001	S
Goblet cell number / villus	18.2 ± 1.4	24.9 ± 1.7	0.0045	S
Mucosal thickness (μm)	1135.6 ± 39.5	1384.2 ± 47.8	0.0018	S

Values are expressed as mean $\pm$ SE. S = Significant at $p<0.05$

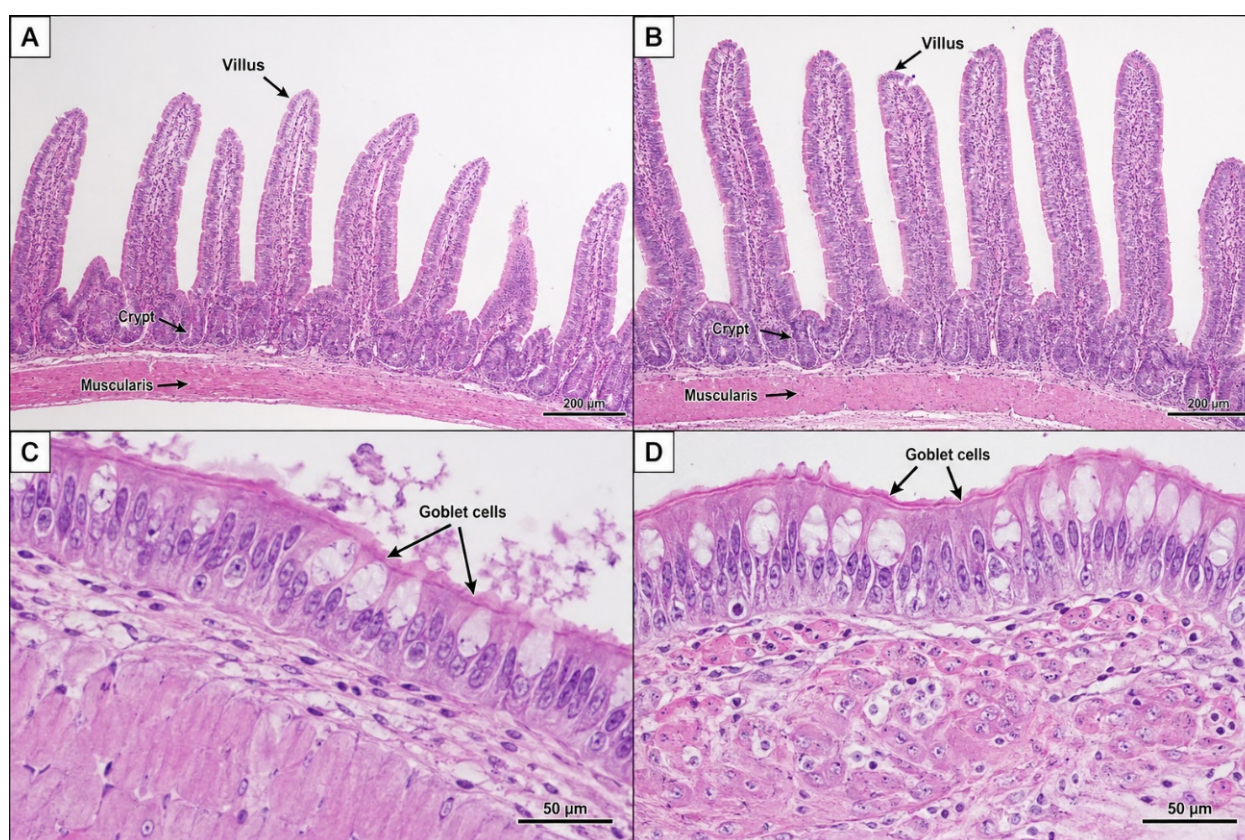


Fig 1: Ileal histological sections of broiler chickens in the bitter phytogetic-treated groups. A: normal villi, crypts, and muscularis in the control group. B: elongated villi, shallower crypts, and improved mucosal organization in the treated group. C and D: goblet cells, with greater goblet cell density and epithelial maturation observed in the treated birds. 200 μm (A-B) and 50 μm (C-D)

Relative expression of ileal TAS2R7 gene

The ileal TAS2R7 expression in the birds receiving the bitter phytogetic supplementation increased dramatically in the quantitative real-time PCR. The use of the $2^{-\Delta\Delta C_t}$ method found that the expression of the mRNA level of TAS2R7 increased to about 3.41 in the supplemented group in comparison to the control, $p=0.0006$. The amplification plots illustrated that the bio-replicates of the experimental groups performed steady exponential amplification, while the

generated melting plots illustrated the presence of only a single specific peak, and the absence of primer-dimer formed, which suggested high specific primer. The increased expression of the TAS2R7, suggested phytogetic bitter components in the birds' diet modulated local chemosensory signaling cascades within the intestinal epithelium that catalyzed the mucosal sensory adaptive changes in the structure and the relief of nutrients integration (Figure 2).

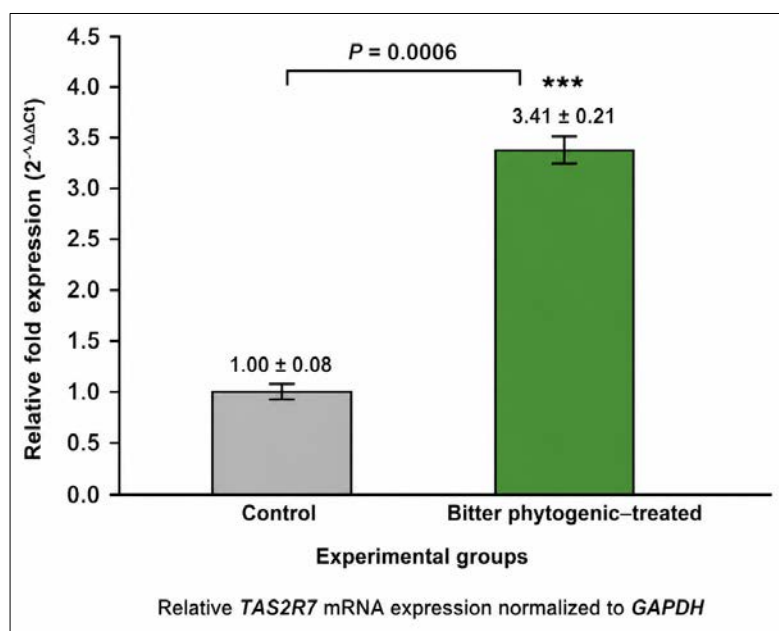


Fig 2: Relative ileal TAS2R7 mRNA expression in control and bitter phytogetic-treated broiler chickens

Correlation between TAS2R7 expression and histological properties of the ileum

Within the ileum the Expression of the TAS2R7 gene up to and including the increased activity of the bitter receptors compared to the control was most positively and significantly correlated to transcription of goblet cell density within the ileal mucosa (which denotes a form of cellular barrier defense that is enhanced by the activation of mucosal defense) versus the control ($p \leq 0.00141$) ($\Delta E = 0.55$). Also, it correlated to increased surface development of the epithelium ($p \leq 0.00145$) ($\Delta E = 0.57$) whereby the depth of the epithelium was positively related ($p \leq 0.0198$) ($\Delta E = 0.45$) to the average rate of the cell turnover was significantly decreased (i.e. length of depth of the epithelium decreased in activated state). Thus, with the expression of the TAS2R7 gene, bitter receptor signaling within the intestine was positive, the villus height was increased, the cell turnover rate at crypts depth was decreased, and the average cell depth was significantly decreased ($p \leq 0.42$) ($\Delta E = 0.57$). Optimal signaling through TAS2R7 receptors was greatest with a ratio of villus height and average cell depth of crypts, and it was ≤ 0.0199 dependent (Table 3).

Table 3: Pearson correlation coefficients between ileal TAS2R7 gene expression and histological parameters

Parameter	Correlation coefficient (r)	P-value	Correlation type
Villus height	+0.81	0.0003	Strong positive
Villus width	+0.66	0.0031	Moderate positive
Crypt depth	-0.69	0.0021	Strong negative
Villus height / crypt depth ratio	+0.84	0.0001	Very strong positive
Goblet cell number	+0.74	0.0014	Strong positive
Mucosal thickness	+0.71	0.0019	Strong positive

Discussion

In this study, we found that the inclusion of dietary bitter phytochemicals improved several vet-parameter traits in broilers. Traceable changes to broiler growth metrics, improvement in the intestinal architecture, and gene expression changes in TAS2R7 in the ileum were all evident. Compared to the unaltered group, post-treatment subjects had substantial

improvements in body weight at final measurement, growth since the last measurement, and improvements in the feed conversion ratio. Compared to several new studies in poultry nutrition, positive changes were due to improved gut efficiency and changes in dietary raw additives. Hussein *et al.* (2023) [6] reported notable improvements in growth and intestinal health due to the supplementation of mixtures of phytochemicals Magic oil, while Dong *et al.* (2024) [3] noted improvements in gut morphology, immune activity, and feed efficiency due to the supplementation of broilers with combinations of essential and organic acids. Productive gains were obtained from supplementation of postbiotics and beneficial probiotics, all of which resulted in improved gut health and growth. We attempt to move away from the obsession with feed quantity and towards gut health. The interpretation of poorly scalable abilities dictates the productive efficacy of modern broilers. with the bitter phytochemicals in diet we presuppose noted improvement to be due to the increase in absorptive capacity and the bitter phytochemicals, and a diminished emphasis on feed quantity in the modern broiler diet.

From a histological perspective, in a majority of parameters, supplemented birds demonstrated that the elongation of villi, reduction in the depth of crypts, increase in villi height to crypt depth ratio, and an abundance of goblet cells, as indicators of the remodeling of the intestinal mucosa to a healthier, more absorptive state. Increased villi height is also in accordance to the increased epithelial surface area and enhanced nutrient absorption, whilst decreased depth of crypts is suggestive of a decline in epithelial turnover stress and a tempered wave of shedding of the mucosa. These results are in alignment with the meta-analysis by Yosi and Metzler-Zebeli (2023) [14], which demonstrated that the dietary additives that could modulate the gut and change its functioning reliably improved the intestinal histomorphology and the epithelial linings of the gut in broilers. Similarly, Shehata *et al.* (2022) [8] evidenced that the nutritional microbial modulation incorporated in the diet of chicks improved the ileal morphology and the intestinal genes. Recent studies have also clarified that enhancements in villus development and mucosal organization in the presence of stress and in the absence of stress are attributable to the combined use of probiotics, phytochemicals, and postbiotic supplements (Bhattarai *et al.*, 2025) [15]. The increased goblet cell density

helped in the study, as goblet cells are known to produce mucins which fortify the mucosal barrier and help epithelial barriers by enhancing the adhesion of pathogens.

Conclusion

The most innovative result of this study was the increase in bitter phytochemical supplementation's ability to upregulate ileal TAS2R7 in the participants. As a result of this upregulation, it was determined that not only was bitter supplementation a feed additive, it also served as a signaling molecule that could activate the intestinal chemosensory pathways as a feed additive. While it was previously assumed that bitter taste receptors could only be found in the mouth, recent studies have shown that bitter taste receptors could also be found in the intestines. There, they play a role in the regulation of intestinal functions, including epithelial renewal, secretion, and defense. A significant increase in TAS2R7 mRNA levels, coupled with a positive correlation to the height of villi and goblet cells, was indicative of a relationship between receptor activation and intestinal functionality. This phenomenon was also noted in chickens, indicating that the bitter taste receptors could be of use in chemosensory taste perception. Although the studies of poultry in the past focused a lot on the bacteria in the intestines, the metabolites of digestion, and the study of immune genes, the use of signaling from intestinal bitter receptors to mucosal changes is a new pathway. Based on the findings of this study, bitter phytochemical molecules in chicken feed can be beneficial to intestinal functionality by enhancing epithelial cells and can also help conserve energy.

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Conflict of interest

No conflict of interest is found.

References

1. Alimohammadi Z, Shirzadi H, Taherpour K, Rahmatnejad E, Khatibjoo A. Effects of cinnamon, rosemary and oregano on growth performance, blood biochemistry, liver enzyme activities, excreta microbiota and ileal morphology of *Campylobacter jejuni*-challenged broiler chickens. *Vet Med Sci*. 2024;10(6):e70034.
2. Dey B, Kawabata F, Kawabata Y, Nishimura S, Tabata S. Bitter taste sensitivity and the expression of bitter taste receptors at different growth stages of chicks. *J Poult Sci*. 2018;55(3):204-9.
3. Dong Y, Gao X, Qiao C, Han M, Miao Z, Liu C. Effects of mixed organic acids and essential oils in drinking water on growth performance, immune function, intestinal morphology and microbiota of broilers. *Animals*. 2024;14(15):2160.
4. El-Sayed Y, Khalil W, Fayeze N, Mohamed Abdel-Fattah AF. Enhancing effect of oregano essential oil and *Bacillus subtilis* on broiler immune function, intestinal morphology and growth performance. *BMC Vet Res*. 2024;20(1):112.
5. Hussein EOS, Ahmed SH, Abudabos AM, Suliman GM, Abd El-Hack ME, Swelum AA, *et al*. Effect of water supplementation of Magic oil at different growing periods on growth performance, carcass traits, blood biochemistry, and ileal histomorphology of broiler chickens. *Poult Sci*. 2023;102(7):102768.
6. Hussein EOS, Ahmed SH, Abudabos AM, Suliman GM, Abd El-Hack ME, Swelum AA, *et al*. Effect of water supplementation of Magic oil at different growing periods on growth performance, carcass traits, blood biochemistry, and ileal histomorphology of broiler chickens. *Poult Sci*. 2023;102(7):102745.
7. Shehata AM, Paswan VK, Attia YA, Abougabal MS, Khamis T, Alqosaibi AI, *et al*. In ovo inoculation of *Bacillus subtilis* and raffinose affects growth performance, cecal microbiota, volatile fatty acid, ileal morphology and gene expression, and sustainability of broiler chickens (*Gallus gallus*). *Front Nutr*. 2022;9:903847.
8. Shehata AM, Paswan VK, Attia YA, Abougabal MS, Khamis T, Alqosaibi AI, *et al*. In ovo inoculation of *Bacillus subtilis* and raffinose affects growth performance, cecal microbiota, volatile fatty acid, ileal morphology and gene expression, and sustainability of broiler chickens (*Gallus gallus*). *Front Nutr*. 2022;9:903847.
9. Su Y, Li D, Gaur U, Wang Y, Wu N, Chen B, *et al*. Genetic diversity of bitter taste receptor gene family in Sichuan domestic and Tibetan chicken populations. *J Genet*. 2016;95(3):675-81.
10. Veluri S, González-Ortiz G, Bedford MR, Olukosi OA. Stimbiotic and wheat bran inclusion in maize or wheat-based diets for broiler chickens: effects on jejunal histomorphology, digesta oligosaccharides and caecal short-chain fatty-acids profiles. *Br Poult Sci*. 2024;65(4):465-77.
11. Waghmare S, Gupta M, Bahiram KB, Korde JP, Bhat R, Datar Y, *et al*. Effects of organic acid blends on the growth performance, intestinal morphology, microbiota, and serum lipid parameters of broiler chickens. *Poult Sci*. 2025;104(1):104546.
12. Yadav S, *et al*. Cassava (*Manihot esculenta*) root chips inclusion in the diets of broiler chickens: effects on growth performance, ileal histomorphology, and cecal volatile fatty acid production. *Poult Sci*. 2019;98(11):5303-11.
13. Yosi F, Metzler-Zebeli BU. Dietary probiotics modulate gut barrier and immune-related gene expression and histomorphology in broiler chickens under non- and pathogen-challenged conditions: A meta-analysis. *Animals*. 2023;13(12):1970.
14. Yosi F, Metzler-Zebeli BU. Dietary probiotics modulate gut barrier and immune-related gene expression and histomorphology in broiler chickens under non- and pathogen-challenged conditions: A meta-analysis. *Animals*. 2023;13(12):1970.
15. Bhattarai L, Gautam B, Raut BB, Chettri S. Globozoospermia. *Kathmandu Univ Med J (KUMJ)*. 2023;21(81):98-99. DOI:10.3126/kumj.v21i1.80584.

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