Proximate composition of clove bud (*Syzygium aromaticum*) and black seed (*Nigella sativa*) powder as phytogenic feed additives

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Abstract
This study evaluated the proximate composition of clove bud powder (CBP) and black seed powder (BSP) as phytogenic feed additives. Clove buds and black seeds were purchased from the metropolitan market in Kano state, Nigeria. Healthy and mature buds of clove (*Syzygium aromaticum*) and black seed (*Nigella sativa*) were cleaned and air dried in a ventilated drying oven. The samples were ground using laboratory hammer mill into a fine powder. Results showed that CBP had the highest ash content (5.56 %) with BSP recorded the lowest (4.32 %). Meanwhile, the highest moisture content (9.66 %), lipid (36.67 %) and protein content (19.96 %) were observed in BSP with CBP recording the lowest (8.66 %), (13.00 %), (7.89 %) respectively. It was concluded that both CBP and BSP could be used as phytogenic feed additives so as to improve the animals' health, growth performance and milk quality.

Keywords: clove bud powder, black seed powder, proximate, phytogenic, additives

Description of Problem

Phytogenic feed additives are herbs and spices of natural origin and medicinal products used in animal nutrition to enhance their performance (1). They serve as natural replacements for traditional probiotics and prebiotics which are preferred by consumers for animal feed in dairy cows (2). They can improve digestive secretions, enhance nutrient digestibility and absorption and stimulate immune function within the gut (3). Aside their medicinal properties, they are rich in essential nutrients like protein, minerals and so on (2). The most commonly used herbs and spices include: black seed, basil, turmeric, cinnamon, clove, dill, ginger, mint, oregano, rosemary, saffron, sage, thyme among others (4). The clove bud (*Syzygium aromaticum*) powder (CBP) contains about 5.98% protein, 20% total fat, 61.21% carbohydrates, 34.2% fibers, and 5.88% ash (5). The black seed (*Nigella sativa*) powder (BSP) contains about 18.09 - 26.7 % protein, 28.5 - 45.4 % fat, 5.11 – 18.96 % fiber, 4.39 – 7.1 % moisture and 9.52 – 40.0 % carbohydrates (6; 7; 8). Clove (*Syzygium aromaticum*) bud powder and black seed (*Nigella sativa*) powder are rich sources of bioactive compounds, including potent antioxidants and antimicrobial agents (9; 10). The objective was to evaluate the chemical properties of clove bud and black seed powder used as phytogenic feed additives in dairy cows.

Materials and Methods

Study area

The experiment was conducted at the University of Life Sciences, King Mihai I of Timisoara, Romania lies in the Western part of the country – Romania. It is located between longitude $45^0$78'83.84" N and latitude 21^0 22'60.11" E. Climate in the region is moderate continental with slight Mediterranean influences (11) with an altitude of 90 m above sea level (12). The climate of Timisoara is continental with cold winters and warm summers. In winters, temperature can reach -15 ^oC or even below while during summer, temperature can reach or exceed 35 ^oC. The average temperature of the coldest month (January) is 0.1 ^oC, that of the warmest month (August) is 22.5 ^oC with an intermediate level of precipitation 595 mm (23.4 inches) per year which ranges from 30 mm in the driest month (February) to 85 mm in the wettest one (June).

Experimental materials

Clove buds and black seeds were purchased from the metropolitan market in Kano state, Nigeria.

Preparation of clove bud powder (CBP) and black seed powder (BSP)

Healthy and matured buds of clove (*Syzygium aromaticum*) and black seed (*Nigella sativa*) were cleaned and the dust free samples were air dried at 30°C for 30 minutes in a ventilated drying oven with a model no. (BOV-T50F BIOBASE). The samples were processed as described by (13).

Determination of chemical properties of CBP and BSP

The chemical properties; moisture, ash, lipid and protein content were determined as described by AOAC (14).

Statistical analysis

Data collected on chemical properties of CBP and BSP were analysed for variance (ANOVA) and differences among means were separated using Tukey-HSD in a JMP version 17.0 package.

Results and Discussion

Table 1 shows the proximate composition of CBP and BSP used for the experiment. The BSP revealed high moisture content, lipid and protein than CBP while the highest ash content was recorded in CBP. Additionally, the proximate composition values obtained in this research is within the range reported in the previous studies. In line with the findings, the proximate composition of *Nigella sativa* (black seed) seeds recorded by (15) showed 24.7% protein, 32.5% fat and 4.1% ash for BSP. Similar reports for black seed were reported by (6) for protein (20%) and ash (4.5%). However, lower values of cloves were reported by (16) for fat (6.13 %) protein (4.96 %) while similar values were reported for ash (5.24 %). Milind and Deepa (17) obtained protein value of 5.80 % and ash 5.88 % in clove seeds which compared favourably with the current finding while higher values were reported for fat (20 %). Adebisi *et al*. (18) investigated on the proximate composition of clove and turmeric and found lower values for fat (2.90 %, 1.50 %) and higher values for moisture content (13.29 %, 12.18 %), respectively compared to the current study. The ash content of 4.95 % for clove reported by (18) is similar to CBP and BSP in this research whereas higher value of ash content (6.29 %) for turmeric was reported. The ash content of 5.56 % recorded in CBP in this investigation shows that it will have a reasonable amount of mineral. The protein content obtained for CBP in this study is higher than 5.87 % recorded for clove by Adebisi *et al*. (18); additionally, higher values were obtained for BSP in this study. The variation could be due to the extraction method of the herbs and spices, soil type, soil nutrient, farming practices, geographical locations and varied environmental conditions. The higher moisture, lipid and protein in BSP than CBP reported in the research could be due to the fundamentally different plant parts with different biological purposes. BSP, a seed acts as a nutrient store designed by nature to be rich in energy (lipids) and building blocks (protein) to support a new plant's life while CBP a flower bud acts as a reproductive structure, valued for its protective and aromatic compounds (like eugenol in its essential oil), not for storing macronutrients.

Table 1: Proximate composition of clove bud powder (CBP) and black seed powder (BSP) used for the experiment

	TREATMENTS			
Parameters (%)	**CBP**	**BSP**	**SEM**	**P-VALUE**
Moisture	8.66^{b}	9.66^{a}	0.274	<0.01
Ash	5.56^{a}	4.32^{b}	0.105	<0.01
Lipid	13.00^{b}	36.67^{a}	0.031	<0.01
Protein	7.89^{b}	19.96^{a}	0.126	<0.01

[ab] means with different superscript in a row are significantly different; CBP - clove bud powder; BSP – black seed powder; SEM - standard error of the mean; P-VALUE - probability value; ($P < 0.05$).

Conclusion and Application

The research revealed that clove bud powder (CBP) had the highest ash content compared to

black seed powder while black seed powder (BSP) recorded the highest moisture content, lipid and protein content. It is recommended that clove bud and black seed powder could be used as phytogenic feed additives to improve the animals' health, growth performance and milk quality.

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