PE8.20 Oxidative Stability of Pre-cooked Chicken Meat Balls from Broilers Receiving Mate Infusions
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***Abstract*—Considering that lipid oxidation is the major cause of deterioration in meat and meat products and the increasing interest on searching new natural sources of antioxidants, mate has been studied. Dried leaves of *Ilex paraguariensis* are used in infusion to produce a bitter taste beverage consumed largely in South America and found to be an important source of phenolics. The objective of this study was to offer infusions of mate in substitution of drinking water to broiler chickens and evaluate its effect on oxidative stability of pre-cooked breast meat balls. One hundred male broilers fed conventional diets and received water or infusions with 0.1, 0.5 or 1.0% of mate dried leaves *ad libidum* from 11 to 25 days of age. Pre-cooked breast meat balls were stored in the dark at 4ºC during 7 days and the production of secondary lipid oxidation compounds (TBARS) was measured frequently, so as the content of vitamin E. The lowest concentrations of mate treatments resulted in lower TBARS values during storage increasing lipid stability of meat balls. Mate infusion also contributed to protect vitamin E during cooking and storage.**

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***Index Terms — Ilex paraguariensis*, TBARS, Vitamin E, Antioxidant.**

I. INTRODUCTION

MATE (*Ilex paraguariensis*), St. Hilaire, native from and cultivated in Brazil, Argentina, Uruguay and Paraguay, is used to prepare an infusion with a characteristic bitter taste and stimulant effects. Mate is generally accepted for human consumption and is known to have a high content of phenols [1]. Using a four-step evaluation protocol, mate aqueous extracts were found to have a good radical scavenging capacity and to be an attractive natural alternative for antioxidant protection when added directly to the chicken meat products, in comparison to the widely used rosemary [2]. Sensory studies with the addition of mate aqueous extracts directly to chicken meat prior to cooking showed no compromise to the taste [3], however, dietary utilization of natural antioxidants has been reported to improve oxidative stability of raw or pre-cooked chicken meat [4]. The aim of this study was to investigate the supplementation of aqueous mate extracts in the drinking water to broilers and the antioxidant effect on lipid stability of pre-cooked meat balls during chilled storage.

II. MATERIALS AND METHODS

A. Experimental chickens and treatments

One hundred male Cobb broiler chicks were allotted to 20 pens randomly assigned to 4 treatments with 5 repetitions of 5 birds. Birds were fed a starting corn-soybean diet and water or infusion of mate *ad libitum* from 11 to 25 days of age. Experimental treatments consisted of: Control (water) and the substitution of water with three concentrations of mate, as follows: Mate 0.1 (infusion with 0.1% of mate dried leaves); Mate 0.5 (infusion with 0.5% of mate dried leaves); Mate 1.0 (infusion with 1.0% of mate dried leaves).

B. Mate samples and infusions

Dried leaves of mate were obtained from a commercial brand and purchased at the local market of Santa Catarina, Brazil. The infusions were prepared every morning considering the three different concentrations of dried leaves (0.1, 0.5 and 1.0%). The leaves were weighted and packed in permeable cotton bags and kept in hot water (90□C) for 5 minutes. The infusions were cooled in room temperature, in the dark, distributed in the drinkers (one drinker per pen) and offered to the birds.

C. Water consumption and performance

The consumption of water or mate infusions was measured in each two days during fourteen days of the experimental trial. Body weight (BW) and feed consumption were recorded at the end of the trial to calculate weight gain (WG), feed intake (FI) and feed conversion ratio (FCR).

D. Preparation of meat balls

At 25 days of age, eight birds from each treatment were

slaughtered, breast meat was collected, deboned, vacuum packed and stored frozen (-10°C) for 30 days until the production of the meat balls. Breast meat was chopped, minced, weighted and mixed with 0.50% of food grade salt. Meat balls (30 g ± 0.5 g) were produced and vacuum-packed in bags with low oxygen permeability and cooked in boiling water (100 ºC) for 8 min. After cooled on ice, the meat balls were repacked in polyethylene (PE) bags with high oxygen transfer rate (2000 mL/m^2 x 24h x atm) and stored in the dark in a cold room at 4 ºC (± 0,88 ºC) for 7 days.

E. Meat balls samples

Three meat balls from each treatment were analyzed on days 0, 1, 3, and 7 of storage for secondary lipid oxidation products (as TBARS). Prior to storage (day 0) and after 3 days, three samples of fresh and pre-cooked meat were analyzed in duplicate for fatty acid composition. Vitamin E was analyzed on fresh and pre-cooked meat (day 0) and at day 7.

F. TBARS and vitamin E

TBARS were analysed accordingly to Madsen et al. [5] and quantities of α-tocopherol were determined using HPLC-RP as described by Jensen et al. [6].

G. Statistical analysis

Treatments (concentration of mate) and storage time (day 0, 1, 3 and 7) were analysed in a completely randomized design by General Linear Model Procedure and TBARS were used as the response variable. Means of vitamin E results were compared by Tukey test using GLM Procedure (SAS version 8.02, Institute Inc., Cary, NC).

III. RESULTS AND DISCUSSION

The substitution of water by different concentrations of mate infusions did not affected ($P>0.05$) the water consumption or performance of birds (BW, WG and FI, data not shown). FCR was lower for birds with Mate 0.5 treatment (data not shown). The progression of lipid oxidation (as TBARS) in pre-cooked meat balls was increasing during storage time (Fig. 1), as expected, however, the consumption of mate infusions was effective to protect meat balls even at day 1 ($P>0.05$) in all concentrations. After 3 days of storage, meat balls from mate treatments showed lower TBARS values ($P<0.001$) compared to control, however, at the end of storage only the lowest concentrations of Mate (0.1 and 0.5) protected meat balls against oxidation ($P<0.05$; $P<0.001$, respectively). The consumption of infusions of mate showed no significant influence on fatty acid composition (data not shown). All treatments with mate were effective to preserve vitamin E ($P<0.05$) in fresh meat or during cooking (Table 1). After 7 days of storage, 0.5% of mate dried leaves protected vitamin E in comparison to control ($P<0.05$).

IV. CONCLUSION

The supplementation of broilers with mate aqueous extracts in drinking water is effective on protecting breast meat from lipid oxidation, as well as the addition of dried meat directly to the meat; however, more studies are needed.

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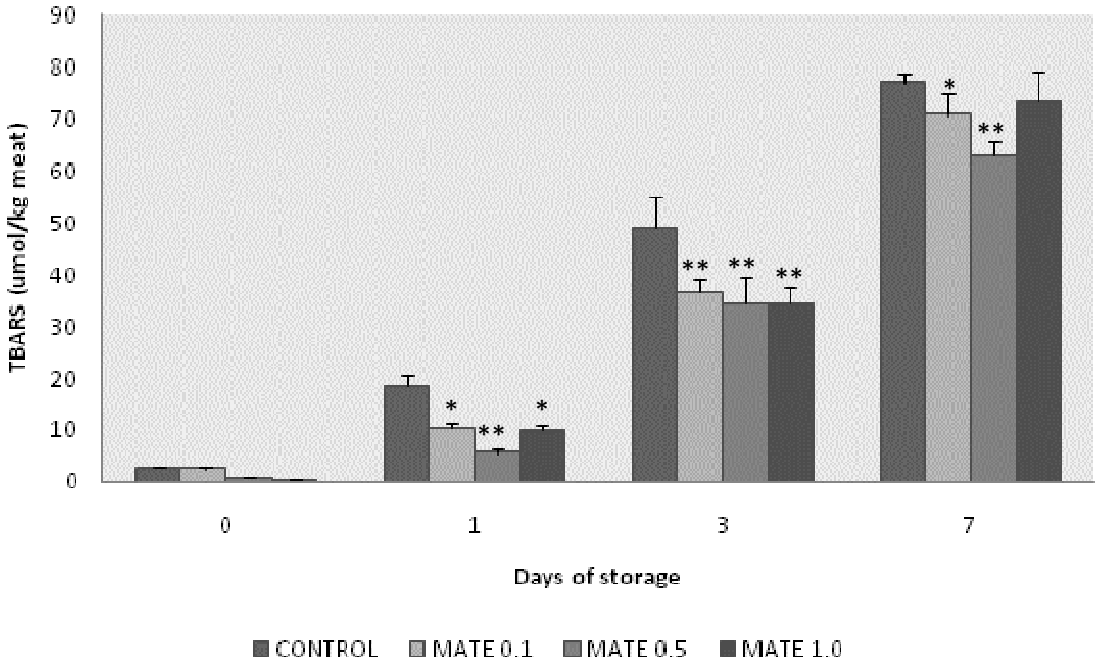

Fig. 1: Effect of mate infusions on the progression of lipid oxidation (TBARS) of meat balls stored at 4ºC during 7 days (*P<0.05 and **P<0.001).

Table 1. Concentration of vitamin E (α-tocopherol; µg/g sample) of fresh and pre-cooked meat balls at 0 and 7 days of storage.

Treatments	N	Fresh	Days of storage	
			0	7
CONTROL	3	$4.3^{a} \pm 0.5$	$3.1^{c} \pm 0.6$	$1.7^{b} \pm 0.4$
MATE 0.1	3	$4.1^{a} \pm 0.2$	$4.1^{a} \pm 0.1$	$1.8^{ab} \pm 0.2$
MATE 0.5	3	$4.2^{a} \pm 0.3$	$3.5^{b} \pm 0.1$	$2.3^{a} \pm 0.2$
MATE 1.0	3	$3.9^{a} \pm 0.5$	$3.6^{ab} \pm 0.1$	$2.0^{ab} \pm 0.2$

[a,b] Different letters indicate significance at 5%