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Effect of different herbs on chicken meat curry as salt substitute

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Abstract
The main objectives of the present study were to standardize the procedure for preparation of low-salt chicken meat curry and to optimize the levels of different flavor enhancers as salt substitutes. A total of six herbal spices were selected: rosemary (R), thyme (T), garlic (G), parsley (P), oregano (O), and ajwain (A). Sensory analysis was statistically evaluated, with sensory scores ranging from 8.23 to 9.47. These high scores indicate good to excellent sensory acceptance, potentially due to the flavonoids in the herbs acting as effective salt replacers (Lee, 2011). Among all treatments, oregano and ajwain showed superior results. In addition to sensory evaluations, the pH and microbial counts of the formulations were monitored to ensure product quality and safety.

Keywords: Low-salt chicken curry, salt substitutes, flavor enhancers

Introduction

Materials and Methods

In the present study an attempt was being made to standardize the preparation of low salt chicken curry by using herbal salt replacers. The product was prepared to arrive at a suitable formulation which can mimic the taste of control product.

For this experiment, a total of 72 chicken of 4-5weeks age of Babcock strain were utilized. Chicken were slaughtered conventionally in six trails of twelve each, in each trail six carcasses were used for chicken curry preparation. The carcasses were deboned manually immediately within three hours after slaughter at the poultry processing unit of the Department of Livestock Products Technology, NTR College of Veterinary Sciences, Gannavaram. The deboned meat was cut into pieces of 3×1×1cm size for preparation of curry and the other group was minced by using a meat mincer (Sirman) through 4mm diameter plate.

Table 1: Formulation of chicken curry with different salt replacers

Parameter	control	Rosemary(R)	Thyme (T)	Garlic (G)	Parsley (P)	Oregano (O)	Ajwain (A)
Chicken meat (%)	74	74	74	74	74	74	74
Spice mix	3	3	3	3	3	3	3
Condiments	7	7	7	7	7	7	7
Binder	3	3	3	3	3	3	3
Salt	1.2	-	-	-	-	-	-
Potassium chloride	-	0.7	0.7	0.7	0.7	0.7	0.7
Herbs	-	0.5	0.5	0.5	0.5	0.5	0.5
water	10	10	10	10	10	10	10
Fat (egetable oil)	5	5	5	5	5	5	5

In this experiment an attempt was made to choose the best suitable herbal-spice for replacement of salt. For this, six types of herbal spices *viz*., rosemary, thyme, garlic, parsley, oregano and ajwain were utilized in this experiment to replace the sodium chloride portion during preparation of curry. The level of incorporation of each spice was determined by trial and error and each herbal spice was added at a level of 0.5 percent into each formulation along with 0.7 percent potassium chloride.

Chicken curry preparation was made utilizing traditional style of cooking and composition of different treatments of preparation were presented in Table1. All the formulations of chicken curry were subjected to sensory evaluation by semi trained taste panel were evaluated for

colour, flavour, tenderness, saltiness, juiciness, and overall acceptability on a 9 point hedonic scale.

pH values were measured using a calibrated digital pH meter (Hanna Instruments) immediately after preparation and on days 1, 3, and 7 of storage at 4°C. Microbial counts (total plate counts, yeast, and mold counts) were determined by serial dilution and plating on appropriate media, following standard microbiological methods (ISO 4833:2013).

Results of sensory analysis were analysed using statistical version SPSS 24.0 based on versions of Snedecor and Cochran (1994).

Results & Discussion

The results of the research aimed at choosing the best suitable herbal salt replacers among rosemary, thyme, garlic, parsley, oregano, and ajwain are presented here under.

Quality of Chicken Curry with Different Herbal Salt Replacers

The mean sensory scores of low-salt chicken curry incorporated with optimal levels of selected spices were recorded for various attributes: color, flavor, juiciness, tenderness, saltiness, and overall acceptability.

Color

The mean color scores for control, rosemary, thyme, garlic, parsley, oregano, and ajwain formulations were 9.18±0.08, 8.70±0.15, 8.08±0.11, 8.42±0.12, 8.00±0.14, 8.97±0.12, and 9.10±0.09, respectively. The color values of control, oregano, and ajwain were significantly different ($P<0.05$) from other treatments.

Flavor

The mean flavor scores for the same formulations were 9.37±0.03, 8.62±0.12, 8.37±0.08, 8.35±0.07, 8.23±0.08, 9.27±0.09, and 9.25±0.08, respectively. The flavor values of oregano and ajwain were not significantly different from control, while other treatments significantly differed from control. Lower scores were found in parsley and garlic treatments.

Juiciness and Tenderness

The mean juiciness and tenderness scores for control, rosemary, thyme, garlic, parsley, oregano, and ajwain incorporated chicken nuggets were 9.42±0.06, 8.48±0.10, 8.53±0.07, 8.95±0.07, 8.87±0.09, 8.91±0.08, and 8.98±0.06 for juiciness; and 9.47±0.04, 8.82±0.08, 8.93±0.08, 8.90±0.13, 8.58±0.05, 8.98±0.09, and 9.02±0.08 for tenderness, respectively. Higher scores for juiciness and tenderness were found in ajwain, and the least scores were found in parsley.

Saltiness and Overall Acceptability

The mean saltiness and overall acceptability scores for the same formulations were 9.42±0.06, 9.03±0.05, 9.03±0.05, 9.10±0.05, 8.88±0.05, 9.20±0.05, and 9.28±0.06 for saltiness; and 9.43±0.05, 9.10±0.04, 8.95±0.11, 9.25±0.06, 8.77±0.03, 9.32±0.05, and 9.45±0.04 for overall acceptability, respectively. Higher scores for saltiness and overall acceptability were found in ajwain, and the least scores were found in parsley. There was no significant difference between control, oregano, and ajwain, while other treatments differed significantly from control.

Table 2: Sensory scores (Mean ± S.E) of low salt chicken meat curry as influenced by different herbal salt replacers

Parameter	Control	Rosemary (R)	Thyme (T)	Garlic (G)	Parsley (P)	Oregano (O)	Ajwain (A)	Overall mean
Colour	9.18±0.08^{a}	8.70±0.15^{ab}	8.08±0.11^{c}	8.42±0.12^{bc}	8.00±0.14^{c}	8.97±0.12^{a}	9.1±0.09^{a}	8.63±0.08
Flavour	9.37±0.03^{a}	8.62±0.12^{b}	8.37±0.08^{bc}	8.35±0.07^{bc}	8.23±0.08^{c}	9.27±0.09^{a}	9.25±0.08^{a}	8.78±0.08
Juiciness	9.42±0.06^{a}	8.48±0.10^{c}	8.53±0.07^{c}	8.95±0.07^{b}	8.87±0.09^{b}	8.91±0.08^{b}	8.98±0.06^{b}	8.88±0.05
Tenderness	9.47±0.04^{a}	8.82±0.08^{bc}	8.93±0.08^{b}	8.90±0.13^{bc}	8.58±0.05^{c}	8.98±0.09^{b}	9.02±0.08^{b}	8.96±0.05
Saltiness	9.42±0.06^{a}	9.03±0.05^{cd}	9.03±0.05^{cd}	9.10±0.05^{bcd}	8.88±0.05^{d}	9.20±0.05^{bc}	9.28±0.06^{ab}	9.13±0.03
Overall Acceptability	9.43±0.05^{a}	9.10±0.04^{bc}	8.95±0.11^{cd}	9.25±0.06^{ab}	8.77±0.03^{d}	9.32±0.05^{ab}	9.45±0.04^{a}	9.18±0.04

Note: Means bearing at least one common super script do not differ significantly. ($p< 0.01$)
± standard error

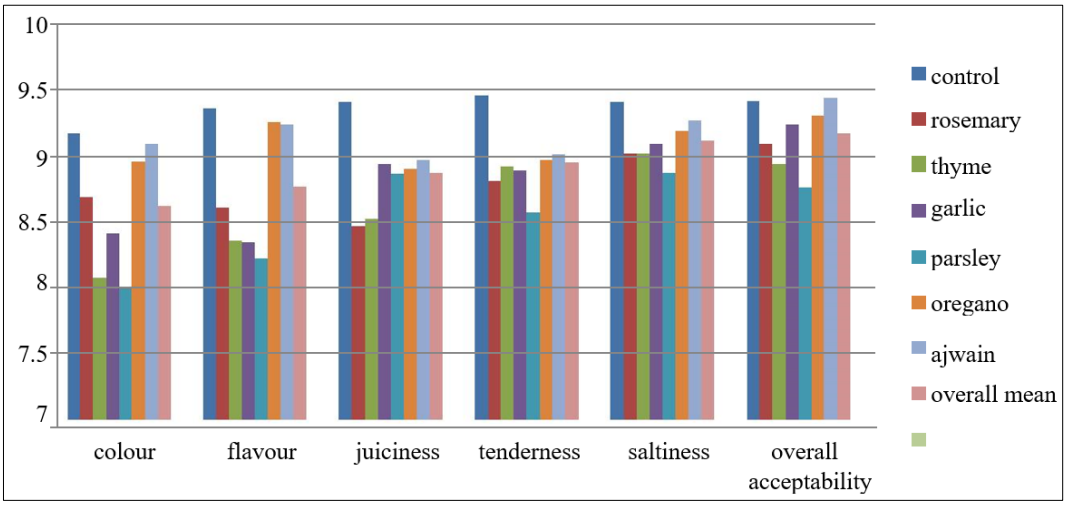

Fig 2: Sensory quality of low sodium Chicken meat curry with different herbal salt

Replacers

The initial pH values for all treatments ranged between 6.12 and 6.34. During storage, the pH of all formulations gradually decreased, with ajwain and oregano treatments maintaining stability longer than others. By day 7, pH values ranged from 5.89 (parsley) to 6.02 (ajwain), indicating minimal spoilage.

The microbial counts (log CFU/g) for all formulations remained within acceptable limits during storage at 4°C. By day 7, total plate counts ranged from 3.21 (oregano) to 4.05 (parsley). Yeast and mold counts were negligible (<1 log CFU/g) across all treatments.

Table 3: pH and Microbial Counts of Low-Sodium Chicken Curry

Treatment	Initial pH	pH (Day 7)	Total Plate Count (log CFU/g, Day 7)	Yeast & Mold Count (log CFU/g, Day 7)
Control	6.24	6.01	3.89	<1
Rosemary	6.21	5.95	3.94	<1
Thyme	6.22	5.97	3.87	<1
Garlic	6.18	5.91	4.01	<1
Parsley	6.12	5.89	4.05	<1
Oregano	6.30	6.02	3.21	<1
Ajwain	6.34	6.02	3.25	<1

Developing low-salt meat products is a key strategy for promoting healthier diets and addressing health risks associated with high sodium intake. Reducing sodium in meat products is challenging because sodium chloride (salt) is crucial for protein hydration and solubility, which significantly impact the texture and moisture retention of meat (Park *et al*., 1996; Goh *et al*., 2021) [8, 4]. Additionally, salt plays a vital role in flavor enhancement, making its reduction a sensory challenge.

Researchers have explored various salt substitutes, primarily focusing on potassium salts and herb and spice blends. Potassium chloride is often used due to its similar ionic properties to sodium chloride, which helps lower sodium intake while maintaining functionality. However, it can impart a bitter taste that affects consumer acceptance (Lee *et al*., 2011; Park *et al*., 2020) [6, 7]. On the other hand, herbs and spices not only enhance flavor but also offer potential health benefits and can mask the undesirable taste of potassium chloride.

In a recent study, a combination of potassium chloride and herbs such as rosemary, thyme, garlic, parsley, oregano, and ajwain was used to replace sodium chloride in chicken curry preparations. The goal was to reduce salt content without compromising the product's quality and shelf stability. Sensory evaluations indicated that the treated products received scores ranging from 8.23 to 9.47, reflecting good to excellent acceptance. The presence of flavonoids in the herbs and spices likely contributed to this positive outcome, as flavonoids can enhance the perception of saltiness (Lee *et al*., 2011; Katsiari *et al*., 2022) [6, 5].

Recent studies have further supported these findings, emphasizing the effectiveness of herb and spice blends in improving the sensory quality of low-sodium meat products. Herbs such as oregano and ajwain were particularly notable, achieving the highest sensory scores in the study. This suggests their potential as effective herbal salt replacers in low-sodium meat products (Carraro *et al*., 2012; Del Nobile *et al*., 2013; Sun *et al*., 2021) [1, 2, 9]. The overall acceptability and sensory attributes of the low-salt chicken curry formulations were comparable to the control, demonstrating that herbs and spice blends can successfully create low-salt meat products without sacrificing eating quality.

The pH stability observed in oregano and ajwain treatments suggests that these herbs may possess antimicrobial properties, contributing to product shelf life. Their low microbial counts further support this hypothesis, aligning with findings by Del Nobile *et al*. (2013) [2], who demonstrated the preservative effects of herb extracts in meat products.

Incorporating herbs and spices not only maintains the sensory appeal of the meat products but also leverages the health benefits associated with reduced sodium consumption and the nutritional advantages of these natural additives. This approach aligns with consumer trends favoring natural ingredients and clean-label products, offering a promising avenue for the development of healthier, low-sodium meat options.

Conclusion

The use of herbal spices like oregano and ajwain as salt substitutes in low-salt chicken curry showed promising results, achieving high sensory scores and good overall acceptability. The sensory attributes, including flavor, tenderness, juiciness, and saltiness, were comparable to the control, indicating that herbs can effectively enhance the taste while reducing sodium content. Additionally, the stability in pH and low microbial counts of these formulations suggest that oregano and ajwain may contribute to product shelf life. This approach not only supports healthier, low-sodium meat options but also aligns with consumer preferences for natural ingredients.

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