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EFFECT OF CARRAGEENAN, WHEY PROTEIN CONCENTRATE, ISOLATED SOY PROTEIN AND MICROCRYSTALLINE CELLULOSE ON THE CHEMICAL, PHYSICAL AND SENSORY QUALITY OF REFRIGERATED OR FROZEN REDUCED FAT CHINESE PORK MEAT BALL

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ABSTRACT

Carrageenan, isolated soy protein (ISP), whey protein concentrate (WPC) and microcrystalline cellulose (MCC) were added to produce reduced fat Chinese pork meat balls. TBA numbers of all treatments were significantly increased over storage times. The carrageenan treatment yielded a better water-holding capacity than other treatments. The pH values of all treatments decreased significantly in the 7th day of refrigerated storage. The four additives did not significantly affect the performance of Chinese pork meat balls on Instron Warner-Bratzler test. The control treatments scored significantly better on the sensory performance for overall acceptability, but all meat balls were rated acceptable.

INTRODUCTION

In general, Chinese pork meat balls contains approximate 25-30% fat. The primary ingredient currently being used in low fat products is carrageenan but McMinds (1991) reported that not everyone is satisfied with its performance, availability or price. Soy protein, whey, starch, fiber and gum suppliers are all attempting to formulate low-fat meat products.

Carrageenan, isolated soy protein (ISP), whey protein concentrate (WPC) and microcrystalline cellulose (MCC) were used to replace fat in Chinese pork meat balls. Chinese style pork meat balls are generally sold in the chilled or frozen state, but these often develop an off flavor during storage.

MATERIALS & METHODS

Sample preparation:

Pork shoulder were obtained approximately 5 days post mortem. Lean and fat were trimmed and ground separately and then placed in bowl chopper. Ice (5%), salt (1.8%), phosphate (0.3%) and seasonings (sugar 3.5%, MSG 0.3%, white pepper 0.1%) were added. Fat trim (20%) was added at the last step of blending in the control treatment. In the carrageenan treatment, 9.5% water and 0.5% carrageenan were added. In the isolated soy protein, whey protein concentrate, carrageenan+microcrystalline cellulose treatments, 8% water and 2% ISP or 2% WPC or 0.5% carrageenan and 1.5% MCC were added. The 3 cm meat balls were cooked in 90-100 C for 20 minutes. The meat balls were vacuum packed with oxygen impermeable vacuum bags and storage at 4 C for 7 days or at -20 C for 6 weeks.

Chemical analysis:

Moisture, protein and fat analysis were conducted by the Ockerman's method (1985), a pH meter was used. A 9 point scale was used in sensory evaluation. The TBA analysis was Pensel's method (1990).

Statistical analysis:

The data obtained in this study were analyzed using the analysis of variance (anova) and the means were evaluated by the Duncan procedures (SAS, 1985).

RESULTS & DISCUSSION

The TBA analysis:

The TBA analysis of variance showed that the interaction between treatment and storage time was significant. For each treatment, the TBA values increased as the storage time increased. According to Ockerman (1985), rancid flavor can be detected by sensory evaluation at a TBA number above 1 mg/kg. In this research, the TBA values were below 1 mg/kg in all cases and no rancid flavor was detected in any treatment and storage time condition.

pH measurements:

There was no significant interaction for pH between treatment and storage time. Lower pH values was obtained at the 7th day of refrigerated storage. The result agreed with the data of Chen et al., (1992) that the pH value of Chinese pork meat balls stored at 4 C, decreased as storage time increased. There was no major pH difference cause by treatments or frozen storage time.

Sensory evaluation:

Analysis of variance for sensory evaluation showed that the interaction between treatment and storage time were not significant. Juiciness scores were highly affected by the addition of carrageenan. In carrageenan treatment, 14.5% of water was added instead of 13% in the other treatments and 5% in the control. For the overall acceptance, lower scores were obtained at the 7th day of refrigerated storage and 6th week of frozen storage. Overall the control treatment was favored by the panelists and resulted in a significantly ($p<0.05$) higher overall acceptance score. Whey protein concentrate had a relative low score (often not significant) at most storage times. Of the various additives, carrageenan often had the highest rating, also usually the scores decreased with both refrigerated and frozen storage.

Conclusion

It is possible to conclude that the reduced fat Chinese pork meat balls are acceptable but the control treatment with less water added (5%) and a higher fat level (18%) presented a better performance than other treatments.

The carrageenan treatment maintained a higher juiciness score than other additives during storage. Carrageenan was a useful fat replacer in Chinese pork meat balls.

The length of refrigerated and frozen storage proved to have a significant influence on the TBA values. The TBA values increased as the storage time increased at both storage

conditions. However, the overall TBA values are less than 1 mg/kg, so no rancid flavor was found. Those Chinese pork meat balls were still acceptable at 7 days of refrigerated or 6 weeks of frozen storage.

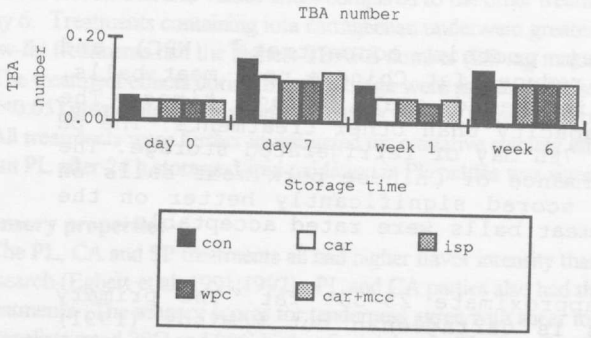

Figure 1. Influence of treatments on Chinese pork meat balls with different storage time as measured by TBA analysis.
There is an interaction between treatment (con,car,isp,wpc and car+mcc) and storage time.
The TBA numbers expressed as malonaldehyde mg/kg.
day0-day7=refrigerated storage time in days,
week1-week6=frozen storage time in weeks.

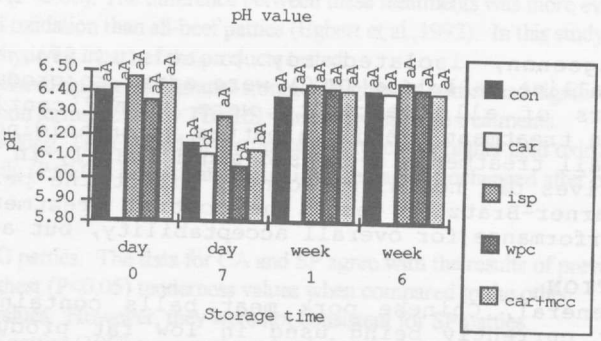

Figure 2. Influence of treatments on Chinese pork meat balls with different storage time as measured by pH.
[a,b] points bearing different superscript lower case letters on the same treatment are significantly different, [A] points bearing different superscript letters on the same storage time are significantly different,
The TBA numbers expressed as malonaldehyde mg/kg.
day0-day7=refrigerated storage time in days,
week1-week6=frozen storage time in weeks.

Table 1. Sensory evaluation of Chinese pork meat ball during storage

Treatment	Control		Carrageenan		ISP[1]		WPC[2]		Car+Mcc[3]	
Test	Juicy[4]	Overall[5]	Juicy	Overall	Juicy	Overall	Juicy	Overall	Juicy	Overall
4 C (day)										
0	6.59^{aA}	7.42^{abA}	6.99^{aA}	6.85^{abAB}	6.47^{abcA}	6.43^{aB}	6.72^{aA}	6.32^{aB}	6.41^{aA}	6.25^{aB}
7	6.20^{aA}	6.76^{bA}	6.31^{aA}	6.00^{bcA}	5.95^{bcA}	6.16^{aA}	5.79^{bA}	5.64^{aA}	6.12^{aA}	6.17^{aA}
-20 C (week)										
1	6.47^{aA}	7.07^{abA}	7.00^{aA}	6.92^{abAB}	6.73^{aA}	6.64^{aAB}	6.38^{abA}	6.47^{aB}	6.42^{aA}	6.46^{aB}
6	6.57^{aA}	6.81^{bA}	7.07^{aA}	5.88^{cA}	6.63^{abA}	5.78^{aA}	6.36^{abA}	5.81^{aA}	6.78^{aA}	5.79^{aA}

[1]ISP = isolated soy protein, [2]WPC = whey protein concentrate, [3]Car+Mcc = carrageenan+microcrystalline cellulose, [4]Score used: 1=extremely dry, 9=extremely juicy, [5]Score used: 1=very low overall acceptance, 9=very high overall acceptance, [a.b.c] the means with different superscript lower case letters in the same column and same panel item are significantly different ($p<0.05$), [A,B,C] the means with different superscript letters in the same raw and same panel item are significantly different ($p<0.05$),

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