

Effects Of Simmering On Quality Changes Of Low Fat Kung-wans

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Background

"Kung-wan", an emulsified meatball is a popular meat product in Chinese communities. Smaller amount of different plant oils were used to replace pork fat in making low-fat Kung-wans. Since Kung-wans are usually simmered and consumed in warm soup, effects of reheating on their qualities are important and deserved investigation.

Objectives

The aim of this study was to study the effects of a simmering process on the eating qualities of low fat emulsified meatballs formulated with different plant oil fat substitutes.

Methods

The emulsified meatballs or Kung-wans were manufactured with pork leg muscle tissues according to a processing scheme in a previous study (Hsu and Yu, 2001). The Kung-wans were simmered (at around 98.5 degree C) for 15 minutes. The cooked products were kept in 80 degree C water for quality analyses within 30 minutes. A one-way completely randomized design with three replications was adopted for this study. The experimental design consisted of 3 controls and 11 plant oil formulae. The three controls were a positive control of adding 25% pork back fat (ConFa1), a positive control of adding 10% pork back fat (ConFa2) and a negative control of adding 10% water (ConWa). The 11 plant oils included coconut oil (Coco), sunflower oil (Sunf), palm oil (Palm), corn oil (Corn), peanut oil (Pean), soybean oil (Soyb), tea seed oil (Teas), olive oil (Oliv), hydrogenated coconut oil (H-coco), hydrogenated palm oil (H-palm) and hydrogenated soybean oil (H-soyb). The compositions of the other ingredients were fixed at 4% sugar, 0.25% polyphosphates and 2.5% NaCl. Total number of specimens was 42. SAS (SAS, 1988) and SPSS (SPSS, 1984) statistical packages were used for all statistical analyses.

Cooking losses and product proximate compositions, texture profile analyses indices, Hunter-Lab values, diameters, peroxide values (POV) and thiobarbituric acid (TBA) values were measured and panel tests were conducted according to a previous reports (Hsu and Yu, 2001).

Results and discussions

As shown in Tables 1 and 2, some quality indices of the controlled group; namely ConFa1, ConFa2 and ConWa, differed significantly. ConWa had highest weight loss (6.6%) in the simmering process due to losses of moisture and soluble proteins (Table 1 and data in a previous study: Hsu and Yu, 2001). Weight loss in ConFa1 (4.3%) was due to loss of soluble proteins and that in ConFa2 (2.3%) was due to losses of moisture and soluble proteins. These results could indicate that stability of the meat emulsion was degraded in the reheating process by the added water and pork fat. Less amounts of added moisture and fat resulted in more stable emulsion products. ConWa was significantly lower in cohesiveness, elasticity and thiobarbituric acid (TBA) values than ConFa1 and ConFa2. These resulted in lower sensory acceptability of ConWa.

Comparing to the unheated Kung-wans (Table 1, 2 and data from Hsu and Yu, 2001), simmering process enlarged the low fat meatballs from a diameter of 2.7 cm to 2.9 cm. All plant-oil Kung-wans reduced in moisture content except for coconut and corn oils. All plant-oil Kung-wans increased in lipid content except for palm and peanut oils. Almost all low-fat products decreased in hardness, adhesiveness, viscosity, chewiness and gumminess due to the increase in size and decrease in density. Products made of palm, peanut, tea-seed, olive and hydrogenated soybean oils also decreased in brittleness. Most plant-oil products increased in lightness (Hunter-L value), but decreased in red (Hunter-a value) and yellow (Hunter-b value) colors. All plant-oil products decreased in peroxide value (POV) except for peanut and tea-seed oils, which were crude extracts produced locally without adding antioxidant. One of the plant oils decreased in TBA values while 10 of them increased. In summary, simmering made the Kung-wans larger, softer, lighter and pale in color. Panel scores of all simmered products were decreased in color while some increased and some decreased in odor, taste, texture and overall acceptance.

Conclusions

Significant amounts of weight (up to 6.6%) were lost in the simmering. Simmering made the Kung-wans larger, softer, lighter and pale in color.

Reference

Hsu, S.Y. & Yu, S.H. (2001). Comparisons on 11 plant oil fat substitutes for low-fat kung-wans. *Journal of Food Engineering* (In press).

TABLE 1

Changes in cooking losses, diameter, proximate compositions and texture profile analysis indices of low fat Kung-wans after simmered for 15 minutes

Treatment	Cooking loss (%)	Diameter (cm)	Moisture (%)	Lipid (%)	Hardness (g)	Adhesion (erg)	Brittleness (g)	Viscosity (g)	Cohesiveness	Elasticity	Chewiness (g)	Gumminess (g)
ConFa1	4.3 ab	0.2 a	0.4 ab	0.6 a	-58 ab	-52 ab	212 a	-50 ab	0.05 ab	0.01 ab	-76 a	-80 a
ConFa2	2.3 abcd	0.2 a	-1.3 ab	1.2 a	-147 ab	-74 ab	81 ab	-46 ab	0.04 ab	-0.04 abc	-190 bcd	-185 bc
ConWa	6.6 a	0.2 a	-0.5 ab	0.1 a	-39 a	-81 ab	-126 ab	-37 a	-0.07 c	-0.14 d	-185 bcd	-165 abc
Coco	1.5 abcd	0.2 a	0.2 ab	1.2 a	-143 ab	-90 ab	116 ab	-64 ab	0.02 ab	-0.05 abc	183 d	-234 c
Palm	2.2 abcd	0.2 a	-0.5 ab	-0.6 a	-140 ab	-7 a	-125 ab	-39 a	0.04 ab	0.01 ab	-94 ab	-103 ab
Soyb	1.3 bcd	0.1 a	-1.2 ab	0.6 a	-110 ab	-88 ab	52 ab	-58 ab	0.06 ab	0.01 ab	-143 abcd	-153 abc
Sunf	3.1 ab	0.2 a	-1.1 ab	0 a	-132 ab	-67 ab	6 ab	-41 a	0.05 ab	0.01 ab	-112 abc	-122 ab
Corn	0.8 cd	0.2 a	0.8 a	1.0 a	-202 b	-73 ab	107 ab	-46 ab	0.04 ab	-0.01 abc	-159 abcd	-163 abc
Pean	4.3 ab	0.2 a	-0.3 ab	-1.0 a	-166 ab	-35 a	-286 b	-32 a	0 abc	-0.07 bcd	331 ab	-146 abc
Teas	2.5 abcd	0.2 a	-0.8 ab	1.0 a	-215 b	-81 ab	-120 ab	-49 ab	0.06 ab	0.05 a	-140 abcd	-168 abc
Oliv	4.0 abcd	0.2 a	-0.5 ab	1.0 a	-115 ab	-102 ab	-156 ab	-42 ab	0.05 ab	0 ab	-163 abcd	-163 abc
H-coco	3.1 abc	0.2 a	-2.3 b	0.2 a	-112 ab	-148 b	26 ab	-86 b	-0.01 bc	-0.10 cd	247 bcd	-206 bc
H-palm	2.6 abcd	0.2 a	-1.1 ab	1.4 a	-102 ab	-75 ab	32 ab	-46 ab	0.05 ab	-0.03 abc	-157 abcd	-152 abc
H-soyb	0.6 abcd	0.2 a	-0.3 ab	1.3 a	-184 ab	-88 ab	-183 ab	-58 ab	0.07 a	-0.03 abc	-164 abcd	-158 abc

Values in a column not followed by a same letter are significantly different, $p < 0.05$, $n = 3$.

TABLE 2

Changes in Hunter-Lab values, peroxide value (POV, in meq. Oxygen / kg oil), thiobarbituric acid values (TBA, in mg malonaldehyde / kg tissue) and sensory quality indices of low fat Kung-wans after simmered for 15 minutes

Treatment	L	a	b	POV	TBA	Color	Odor	Taste	Texture	Acceptance
ConFa1	-1.5 ab	2.5 a	-2.8 a	1.7 a	0.37 a	-0.0 a	0.13 a	0.19 abc	0.27 a	0.29 a
ConFa2	0.9 a	-0.2 a	-1.5 a	6.4 a	0.28 ab	-0.4 abc	0 a	0.52 a	-0.2 ab	0.01 ab
ConWa	1.4 a	-0.7 a	-0.7 a	0.2 a	0.06 c	-0.3 abc	-0.3 a	-0.0 abc	-0.4 ab	-0.4 b
Coco	1.9 a	-0.8 a	-0.5 a	-1.0 a	-0.01 c	-0.0 a	-0.1 a	-0.2 bc	-0.1 ab	-0.2 ab
Palm	1.3 a	0.9 a	-1.0 a	-0.3 a	0.08 bc	-0.4 abc	-0.2 a	0.14 abc	-0.2 ab	-0.2 ab
Soyb	0.7 a	-0.6 a	-0.6 a	-0.9 a	0.09 bc	-0.4 abc	0.12 a	0.04 abc	-0.0 a	0.08 ab
Sunf	1.1 a	-0.3 a	-1.6 a	-0.4 a	0.13 bc	-0.4 abc	0.12 a	0.47 ab	0.05 a	0.20 ab
Corn	0.7 a	-1.2 a	-1.3 a	-1.8 a	0.15 bc	-0.0 ab	0.18 a	-0.0 abc	0.15 a	0.05 ab
Pean	0.7 a	-0.4 a	-1.1 a	0.3 a	0.09 bc	-0.2 abc	-0.1 a	-0.1 abc	-0.2 ab	-0.1 ab
Teas	-0.4 ab	-0.6 a	-1.2 a	1.2 a	0.05 c	-0.6 bc	0.13 a	-0.0 abc	-0.3 ab	0.11 ab
Oliv	-4.3 b	3.1 a	-3.5 a	-1.3 a	0.04 c	-0.3 abc	-0.1 a	-0.3 c	-0.4 ab	-0.1 ab
H-coco	-0.1 ab	-0.6 a	-1.4 a	-0.1 a	0.03 c	-0.6 c	-0.0 a	-0.0 abc	-0.8 b	-0.3 ab
H-palm	0.7 a	0.2 a	-1.8 a	-0.9 a	0.14 bc	-0.1 abc	-0.1 a	-0.2 c	0.09 a	-0.0 ab
H-soyb	-0.4 ab	-0.8 a	-0.6 a	-0.2 a	0.03 c	-0.2 abc	0.06 a	0.15 abc	0.03 a	0 ab

Values in a column not followed by a same letter are significantly different, $p < 0.05$, $n = 3$.