# 3-P21

## LIQUID EGG WHITE USED AS A FAT REPLACER IN PORK MEATBALL

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**Key word** : Liquid Egg White, Fat Replacer, Meat Ball.

**Background**

There are many attributes to fat in food system just as there are many different fats used , with different structures and characteristics. Fa contributes to flavor, or the combined perception of mouthfeel, taste and aroma or odor. Fat also provides to appearance, palatability and texture of food and increases the feeling of satiety during meals. High fat intake is related with increased risk for obesity and some cancers and also associated with high blood cholesterol and coronary heart disease (AHA, 1996). The 1995 Dietary Guidelines suggested decreasing total fa intake to no more than 30% of dietary energy intake (USDA and USDHHS, 1995). Meat processors have taken two different ways in formulating and processing lowfat meats. One is to take out the fat, either heating, grinding and centrifuging trimmings. The other way is to use a fat replacer such as whey, egg, soy, gelatin, milk and wheat gluten. However, reducing the fat of emulsion –type products and added water to replace the fa cause leaner products to become firmer, more rubbery, less juicy, dark in color, more costly and less acceptable in terms of skin formation mothfeel, processing yield and increased purge in the vaccum package (Hand et al., 1987; Claus et al., 1989). Careful choice of fat replacements therefore, can provide promoted water holding capacity, enhanced textural properties and reduced cost for emulsion-type meat products.

**Objectives**

The present experiment was performed in order to study liquid egg white (chicken and duck) used as fat replacer in pork meat ball and some reheological properties were determined to find out the optimum level of liquid egg white in emulsion type meat products.

**Materials and Methods**

A Frozen pork ham and lard were used to manufacture an emulsion type meat product –Chinese pork meat ball with Liu et al's method (1993) in this study. A 5, 10, and15 % of liquid chicken egg white or duck egg white was used to replace pork lard, respectively , in the formulation of meat balls and the control lot contained 25% pork lard in this experiment. The gel strength, hardness, pH, and total plate count of meat balls with different amount of liquid egg white were determined during cold and frozen storage and a sensory panel was performed initially and at the end of storage.

**Results and disscusion**

**Rheological properties ( gel strength and hardness):** Data of Table 1 showed gel strength of pork meat balls after replacing part of the lard with chicken or duck egg white was significantly higher than that of the control when the replacing amount was up to 10%. A marked increase in gel strength of all pork meat balls were significantly noted after the 7th day of cold and frozen storage was found in this study. Regarding gel hardness of the products, the results were similar to gel strength.

**Total plate count and pH:** The pH of pork meat ball when liquid chicken egg white or duck egg white was utilized were significantly higher ($P<0.05$) than that of the control lot (Table 2). During cold storage , the pH of the control at the 14th day was significantly higher than that of the others day. But the pH of all products remained stable during frozen storage for 28days. The bacteria count was declined in all products containing more than 10% of chicken or duck egg white and this condition was maintained up to 7 days during cold storage (Table 3).

**Sensory properties:** Basing on the scores of sensory properties of products (Table 4), the optimum level of liquid chicken egg white or duck egg white is 10% when utilized to replace pork lard in pork meat ball. However, the pork meat ball with 15 % liquid egg white replacing, was acceptable by the panelists.

**Conclusion:** The best replacing amount of chicken or duck liquid egg white for lard in low fat pork meatball was 10%.

**Literature :**1) AHA. 1996. Dietary guidelines for healthy Americans. Circulation 94:1795-1800. 2) USDA and USDHHS. 1995. 4th ed., Home and Garden Bulletin, No.232., US Dept. Agriculture and US Dept. Health and Human Services, Washington, D.C. 3) Claus et al., 1989. J. Muse Food 1:1. 4) Hand et al., 1987. J. Food Sci. 52:883. 5) Liu et al., 1992. J. Chinese Soc. Anim. Sci. 21:91.

**Table 1. The gel strength (g) of pork meatball with different replacing amounts of chicken or duck liquid egg white during storage**

| Storage (day) | | Chicken egg white (% ) | | | Duck egg white(% ) | | |
|---|---|---|---|---|---|---|---|
| | Control | 5 | 10 | 15 | 5 | 10 | 15 |
| **Cold** | | | | | | | |
| 0 | $38.14\pm2.52^{by}$ | $42.83\pm2.41^{aby}$ | $45.32\pm3.72^{ay}$ | $43.32\pm2.12^{ay}$ | $41.02\pm3.46^{aby}$ | $46.81\pm3.22^{ay}$ | $47.53\pm4.19^{ay}$ |
| 3 | $36.03\pm1.33^{by}$ | $40.12\pm1.12^{ay}$ | $47.03\pm2.55^{ay}$ | $42.64\pm3.15^{ay}$ | $39.53\pm2.34^{aby}$ | $42.82\pm3.41^{ay}$ | $43.34\pm3.12^{ay}$ |
| 7 | $83.06\pm2.42^{bx}$ | $81.05\pm4.46^{bx}$ | $90.86\pm3.46^{ax}$ | $87.06\pm2.23^{abx}$ | $80.55\pm2.48^{bx}$ | $88.63\pm2.42^{ax}$ | $87.03\pm2.26^{abx}$ |
| 14 | $87.54\pm4.74^{ax}$ | $91.07\pm4.83^{ax}$ | $84.03\pm3.93^{abx}$ | $79.04\pm2.32^{bx}$ | $85.03\pm3.65^{abx}$ | $92.22\pm2.92^{ax}$ | $79.04\pm2.42^{bx}$ |
| **Frozen** | | | | | | | |
| 0 | $38.14\pm2.52^{by}$ | $42.83\pm2.41^{aby}$ | $45.32\pm3.72^{ay}$ | $43.35\pm2.12^{ay}$ | $41.02\pm3.46^{aby}$ | $46.81\pm3.22^{ay}$ | $47.53\pm4.19^{ay}$ |
| 7 | $81.08\pm5.82^{ax}$ | $74.14\pm4.43^{ax}$ | $81.84\pm3.12^{ax}$ | $74.12\pm4.72^{ax}$ | $76.32\pm4.42^{ax}$ | $77.36\pm2.15^{ax}$ | $75.87\pm5.74^{ax}$ |
| 14 | $78.82\pm4.43^{ax}$ | $83.03\pm5.82^{ax}$ | $81.37\pm4.34^{ax}$ | $79.43\pm3.22^{ax}$ | $83.26\pm5.16^{ax}$ | $81.24\pm3.74^{ax}$ | $79.35\pm3.12^{ax}$ |
| 21 | $77.03\pm3.46^{ax}$ | $82.26\pm5.41^{ax}$ | $77.75\pm5.26^{ax}$ | $80.22\pm5.54^{ax}$ | $83.52\pm5.64^{ax}$ | $83.05\pm5.48^{ax}$ | $84.03\pm5.44^{ax}$ |
| 28 | $80.24\pm5.33^{ax}$ | $83.04\pm6.42^{ax}$ | $76.56\pm4.43^{ax}$ | $77.26\pm4.43^{ax}$ | $85.03\pm4.88^{ax}$ | $84.58\pm4.27^{ax}$ | $85.54\pm4.91^{ax}$ |

$^{a\,b}$ Means in the same row followed by the same superscripts are not significantly different at the 5% level.

$^{x\,y}$ Means in the same vertical column followed by the same superscripts are not significantly different at the 5% level.

**Table 2. The pH of pork meatball with different replacing amounts of chicken or duck liquid egg white during storage**

| Storage (day) | Control | Chicken egg white(%) 5 | 10 | 15 | Duck egg white(%) 5 | 10 | 15 |
|---|---|---|---|---|---|---|---|
| **Cold** | | | | | | | |
| 0 | 6.70±0.14$^{bx}$ | 6.92±0.24$^{abx}$ | 7.01±0.04$^{ax}$ | 7.04±0.08$^{ax}$ | 7.05±0.02$^{ax}$ | 7.05±0.10$^{ax}$ | 7.07±0.08$^{ax}$ |
| 3 | 6.88±0.06$^{bx}$ | 7.17±0.06$^{ax}$ | 7.26±0.08$^{ay}$ | 7.21±0.04$^{ay}$ | 7.21±0.06$^{ay}$ | 7.22±0.08$^{ay}$ | 7.21±0.12$^{ay}$ |
| 7 | 6.76±0.04$^{bx}$ | 7.11±0.08$^{ax}$ | 7.21±0.10$^{ay}$ | 7.18±0.08$^{ay}$ | 7.23±0.08$^{ay}$ | 7.23±0.06$^{ay}$ | 7.21±0.08$^{ay}$ |
| 14 | 7.02±0.02$^{by}$ | 7.23±0.06$^{ay}$ | 7.25±0.08$^{ay}$ | 7.23±0.08$^{ay}$ | 7.25±0.06$^{ay}$ | 7.27±0.08$^{ay}$ | 7.23±0.04$^{ay}$ |
| **Frozen** | | | | | | | |
| 0 | 6.70±0.14$^{bx}$ | 6.92±0.24$^{abx}$ | 7.01±0.04$^{ax}$ | 7.04±0.08$^{ax}$ | 7.05±0.02$^{ax}$ | 7.05±0.10$^{ax}$ | 7.07±0.08$^{ax}$ |
| 7 | 6.93±0.02$^{bx}$ | 7.17±0.08$^{ax}$ | 7.03±0.04$^{ax}$ | 7.08±0.06$^{ax}$ | 6.92±0.04$^{bx}$ | 6.95±0.04$^{bx}$ | 6.92±0.08b$^{ax}$ |
| 14 | 6.70±0.06$^{bx}$ | 6.98±0.04$^{ax}$ | 7.02±0.02$^{ax}$ | 7.06±0.06$^{ax}$ | 6.92±0.08$^{ax}$ | 6.99±0.06$^{ax}$ | 6.99±0.10$^{ax}$ |
| 21 | 6.71±0.06$^{bx}$ | 7.02±0.06$^{ax}$ | 7.01±0.06$^{ax}$ | 7.02±0.08$^{ax}$ | 6.92±0.08$^{ax}$ | 6.92±0.04$^{ax}$ | 6.91±0.06$^{ax}$ |
| 28 | 6.75±0.02$^{bx}$ | 7.01±0.04$^{ax}$ | 7.01±0.08$^{ax}$ | 7.07±0.04$^{ax}$ | 6.98±0.12$^{ax}$ | 6.98±0.08$^{ax}$ | 6.95±0.04$^{ax}$ |

$^{a,b,x,y}$ Same as Table 1.

**Table 3. The total plate counts of pork meatball with different replacing amounts of chicken or duck liquid egg white during storage**

| Storage (day) | Control | Chicken egg white(%) 5 | 10 | 15 | Duck egg white(%) 5 | 10 | 15 |
|---|---|---|---|---|---|---|---|
| **Cold** | | | | | | | |
| 0 | 3.43±0.24$^{ax}$ | 3.63±0.28$^{ax}$ | 3.38±0.24$^{ay}$ | 3.28±0.25$^{ay}$ | 3.41±0.14$^{ax}$ | 3.17±0.22$^{ax}$ | 3.16±0.18$^{ax}$ |
| 3 | 3.67±0.26$^{ax}$ | 3.71±0.44$^{ax}$ | 3.54±0.18$^{axy}$ | 3.07±0.12$^{by}$ | 3.30±0.23$^{ax}$ | 2.96±0.20$^{bx}$ | 2.95±0.22$^{bx}$ |
| 7 | 3.62±0.34$^{ax}$ | 3.51±0.18$^{ax}$ | 3.55±0.22$^{axy}$ | 3.12±0.18$^{by}$ | 3.07±0.28$^{by}$ | 2.96±0.18$^{bx}$ | 3.27±0.28$^{abx}$ |
| 14 | 3.69±0.12$^{ax}$ | 3.81±0.16$^{ax}$ | 3.96±0.20$^{ax}$ | 3.83±0.20$^{ax}$ | 3.62±0.20$^{ax}$ | 3.44±0.18$^{ax}$ | 3.75±0.18$^{ax}$ |
| **Frozen** | | | | | | | |
| 0 | 3.43±0.24$^{ax}$ | 3.73±0.28$^{ax}$ | 3.38±0.24$^{ax}$ | 3.28±0.25$^{ax}$ | 3.51±0.14$^{ax}$ | 3.17±0.22$^{bx}$ | 3.16±0.18$^{bx}$ |
| 7 | 3.56±0.22$^{ax}$ | 3.63±0.34$^{ax}$ | 3.69±0.22$^{ax}$ | 3.07±0.22$^{bx}$ | 3.54±0.22$^{ax}$ | 3.14±0.24$^{bx}$ | 3.18±0.16$^{bx}$ |
| 14 | 3.57±0.26$^{ax}$ | 3.20±0.22$^{abx}$ | 3.50±0.34$^{ax}$ | 2.91±0.18$^{bx}$ | 3.75±0.26$^{ax}$ | 3.22±0.26$^{abx}$ | 3.06±0.22$^{bx}$ |
| 21 | 3.54±0.14$^{ax}$ | 3.39±0.36$^{ax}$ | 3.68±0.26$^{ax}$ | 3.07±0.34$^{bx}$ | 3.70±0.12$^{ax}$ | 3.27±0.20$^{ax}$ | 3.00±0.24$^{bx}$ |
| 28 | 3.47±0.22$^{ax}$ | 3.60±0.32$^{ax}$ | 3.63±0.18$^{ax}$ | 3.39±0.28$^{ax}$ | 3.38±0.22$^{ax}$ | 3.59±0.18$^{ax}$ | 3.53±0.18$^{ax}$ |

$^{a,b,x,y}$ Same as Table 1.

**Table 4. Sensory properties of pork meatball with different replacing amounts of chicken or duck liquid egg white during storage**

| Storage (day) | Control | Chicken egg white(%) 5 | 10 | 15 | Duck egg white(%) 5 | 10 | 15 |
|---|---|---|---|---|---|---|---|
| **0 day** | | | | | | | |
| Texture | 4.63±0.34$^{ax}$ | 4.96±0.12$^{ax}$ | 4.62±0.21$^{ax}$ | 4.76±0.21$^{ax}$ | 5.04±0.43$^{ax}$ | 4.14±0.22$^{ax}$ | 4.62±0.26$^{ax}$ |
| Elasticity | 4.54±0.29$^{bx}$ | 5.02±0.25$^{ax}$ | 4.63±0.21$^{abx}$ | 4.34±0.12$^{bx}$ | 4.92±0.24$^{abx}$ | 4.98±0.32$^{ax}$ | 4.51±0.26$^{bx}$ |
| Flavor | 4.75±0.24$^{ax}$ | 4.86±0.21$^{ax}$ | 4.82±0.31$^{ax}$ | 4.45±0.28$^{ax}$ | 4.96±0.22$^{ax}$ | 4.32±0.27$^{ax}$ | 4.64±0.22$^{ax}$ |
| Color | 5.12±0.25$^{ax}$ | 4.94±0.27$^{ax}$ | 5.16±0.25$^{ax}$ | 4.92±0.23$^{ax}$ | 5.23±0.27$^{ax}$ | 4.94±0.34$^{ax}$ | 4.83±0.31$^{ax}$ |
| Total Accept. | 5.14±0.21$^{ax}$ | 5.12±0.19$^{ax}$ | 4.98±0.23$^{ax}$ | 4.68±0.32$^{ax}$ | 4.88±0.22$^{ax}$ | 4.92±0.21$^{ax}$ | 4.61±0.28$^{ax}$ |
| **14 day(cold)** | | | | | | | |
| Texture | 4.72±0.23$^{ax}$ | 4.18±0.21$^{ay}$ | 5.23±0.21$^{ay}$ | 4.93±0.29$^{ax}$ | 4.43±0.19$^{ay}$ | 4.44±0.21$^{ax}$ | 4.91±0.32$^{ax}$ |
| Elasticity | 4.24±0.26$^{bx}$ | 4.50±0.19$^{aby}$ | 4.62±0.19$^{abx}$ | 4.66±0.28$^{abx}$ | 4.74±0.29$^{ax}$ | 4.72±0.19$^{ax}$ | 4.82±0.16$^{ax}$ |
| Flavor | 4.22±0.21$^{ay}$ | 4.28±0.23$^{ay}$ | 4.25±0.22$^{ay}$ | 4.32±0.21$^{ax}$ | 4.27±0.24$^{ay}$ | 4.43±0.19$^{ax}$ | 4.18±0.22$^{ax}$ |
| Color | 4.26±0.22$^{ay}$ | 4.64±0.27$^{ax}$ | 4.78±0.21$^{bx}$ | 4.74±0.22$^{bx}$ | 4.37±0.27$^{ay}$ | 4.53±0.24$^{ax}$ | 4.56±0.24$^{ax}$ |
| Total Accept. | 4.22±0.25$^{ay}$ | 4.32±0.22$^{by}$ | 4.46±0.23$^{ay}$ | 4.48±0.21$^{abx}$ | 4.34±0.22$^{by}$ | 4.36±0.22$^{by}$ | 4.41±0.22$^{bx}$ |
| **28 day(frozen)** | | | | | | | |
| Texture | 4.96±0.21$^{ax}$ | 4.34±0.19$^{bx}$ | 4.74±0.39$^{ax}$ | 4.83±0.22$^{ax}$ | 4.94±0.21$^{ax}$ | 4.64±0.22$^{ax}$ | 4.25±0.29$^{bx}$ |
| Elasticity | 4.48±0.19$^{ax}$ | 4.64±0.17$^{ax}$ | 4.56±0.28$^{ax}$ | 4.84±0.34$^{ax}$ | 4.58±0.21$^{ax}$ | 4.32±0.28$^{ax}$ | 4.54±0.21$^{ax}$ |
| Flavor | 4.84±0.23$^{ax}$ | 4.76±0.23$^{ax}$ | 4.44±0.26$^{ax}$ | 4.42±0.25$^{ax}$ | 4.35±0.26$^{ay}$ | 4.65±0.23$^{ax}$ | 4.37±0.21$^{ax}$ |
| Color | 5.02±0.32$^{ax}$ | 4.70±0.22$^{ax}$ | 4.97±0.21$^{ax}$ | 5.01±0.35$^{ax}$ | 5.26±0.42$^{ax}$ | 4.94±0.32$^{ax}$ | 5.02±0.32$^{ax}$ |
| Total Accept. | 4.56±0.18$^{ay}$ | 4.62±0.25$^{ay}$ | 4.63±0.29$^{axy}$ | 4.65±0.34$^{ax}$ | 5.14±0.37$^{ax}$ | 4.71±0.35$^{ax}$ | 4.68±0.22$^{ax}$ |

$^{ab}$ Means in the same row followed by the same superscripts are not significantly different at the 5% level.

$^{xy}$ Means in the same vertical column and item followed by the same superscripts are not significantly different at the 5% level.