Characterization of commercial wheat flour sold in Myanmar and its application in the fried chicken

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Abstract

Fried chicken has been the most popular fast food in worldwide. The demand was yearly increased due to the change of lifestyle. However, wheat flour that is one of major ingredients to develop dry mix for fried chicken has to be imported. Its cost became expensive. Therefore, this project aimed to determine Myanmar wheat flour quality and to investigate its potential to use for making the dry mix for fried chicken. Three Myanmar flours (flour A, B and C) were selected from the most popular brands. L*, a* and b* of all flours were in the range of 93.06 – 94.58, 0.47 – 0.69, and 7.82 – 9.29, respectively. Their moisture content, fiber content, fat content, ash content and carbohydrate content were 11.79 - 12.85%, 0.73 – 2.74%, 0.86 – 1.18%, 0.21 – 0.43% and 50.27 – 69.08%, respectively. Protein contents of flour A, B and C were 15.23%, 35.22% and 31.12% respectively. For pasting properties, flour B and C had significantly higher peak viscosity, trough, break down, final viscosity and set back than did flour A. Variation in those properties did not affect %pick up and cooking loss ($P>0.05$). However, it affected fat content of fried chicken crust significantly ($P\leq0.05$). The fried chicken crust from flour C had the least fat content (27.12%). Hardness of the fried chicken with flour A, B and C were 13.37 N, 12.80 N and 7.73 N, respectively. Among those flours, flour A and flour B could produce the fried chicken with the highest overall liking score.

Keywords: Myanmar, wheat flour, fried chicken, frying

1. Introduction

Wheat is one of the most important grains for food production. Myanmar can grow many varieties of wheat including Monywa White and Yezin wheat in many regions including Sasaing, Mandalay division and Shan state. In Myanmar, the demand of wheat flour was rapidly increased in order to produce noodle, bread, cookies and other food stuffs. Wheat production in Myanmar was around 78,000 metric tons and kept increased every year. Department of Agricultural planning (Myanmar) reported 173,000 metric ton wheat production in 2011-2012. The cost was 600-1300 Ks (0.6 – 1.3 USD) per kilogram (Ministry of Agriculture and Irrigation, Myanmar 2011), which was generally cheaper than the imported wheat flour (1.0-1.8 USD Per kg). In batter and breading, polysaccharides in flour interacted with protein to provide stability

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Moreover, the polysaccharides sometimes reacted with lipids to provide viscous effects and emulsifying action. Wheat is categorized as hard and soft flour depending on protein content. Soft wheat flour is typically low in protein content (8 -11 %) (Lukow, 2006). The hard wheat tends to contain a high proportion of damaged starch. It requires more water than soft wheat flour in order to produce the same batter consistency (Loewe, 1993).

Wheat flour is a major ingredient for fried battered food. The batter can be classified into two categories including adhesion batter and tempura. Adhesion is normally used as the intermediate layer between meat and exterior batter. It acts as the glue that allows the batter to envelope the substrate. Tempura is defined as a semi-liquid mixture for immersing the product in it. After frying, the products have an attractive external layer, a golden brown color and a crispy texture.

Therefore, this project aimed to determine properties of Myanmar wheat flours and to able to select the wheat flour suitable for developing dry mix of the fried chicken.

2. Materials and Methods:

2.1 Materials

Local purposed wheat flours sold in Myanmar including Diamond star (A), OK (B) and Mwe (C) were purchased from Yangon, Myanmar for coating chicken. Fresh chicken breast meat was cut into rectangular-shaped pieces (55 x 35 x 20 mm). Chicken pieces were marinated with spices and kept at 8 $^{\circ}$C for 1 hour. The dry mix consisted of wheat flour (85.85 %), corn flour (8.68 %), baking powder (2.05%), pepper powder (0.9%), salt (0.9 %), chicken powder (0.7%), paprika powder (0.46%) and sugar (0.46%), respectively.

2.2 Methods

Marinated chicken pieces (500g) were battered with the dry mix twice and deep fried in an electric fryer (Fritel, compact 15, series 98/10, Belgium). The ratio of palm oil to product was 30:1 of palm oil and product. The frying condition was set at 170 $^{\circ}$C for 7 min. Change of new oil was done after frying product 3 kg. Each treatment was fried and evaluated separately. Experiments were designed using CRD (Complete Randomized Design) independently performed in duplicate. Difference of mean was determined in Duncan's test. The statistical analysis was performed using SPSS statistic version 16.0 with 95 % confidence level.

2.2.1 Determination of chemical composition of Myanmar wheat flour

Proximate composition analysis was carried out to determine moisture content, fat content, protein content, fiber content, ash content and carbohydrates content using the method of AOAC (2000).

2.2.2 Determination of physical property of Myanmar wheat flour

Color of wheat flour was determined using spectrophotometer (Minolta CM-3500d; Konica Minolta Holding Inc, Tokyo, Japan), by reflectance. CIELAB parameters (L*, a*, b*) were obtained using a D65 illuminant at 10 $^{\circ}$ C observation. Pasting properties including peak viscosity, trough viscosity, breakdown, final viscosity, setback and pasting temperature were determined using rapid visco analyzer (RVA, 4, Parten Instrument Group, Australia).

2.2.3 Determination of quality of fried chicken from various dry mixes

After the chicken was battered with the dry mix, coating pick up was determined as the amount of coating adhering to chicken meat (Albert *et al.,* 2009). It was calculated using Eqn.1.

$$\text{Coating pick up (\%)} = 100 \times B/ (B + S) \quad (1)$$

where B = mass of coating (g), S = mass of chicken meat (g)

Cooking loss was determined as the loss during frying. It could be calculated using Eqn.2.

$$\text{Cooking loss (\%)} = 100 \times (X1 - X2)/ X1 \quad (2)$$

where X1 = mass of product before frying (g), X2 = mass of final product after frying (g)

Color of the fried chicken crust (L*, a*, b*) was determined using a spectrophotometer (Minolta CM-3500d; Konica Minolta Holding Inc, Tokyo, Japan). Hardness of fried chicken was evaluated using a texture analyzer (Model TA-XT plus, Serial no. 10580, Texture Technologies crop, UK) .The fat content of crust was determined using an auto extraction unit of Soxtec (Tecator, 2050, Hoganas, Sweden). Finally, liking scores of fried chicken samples on thickness of crust, color, crispness and overall were evaluated with 30 untrained panelists using a 9 point hedonic scale.

3. Result and Discussion

3.1 Composition and properties of wheat flour from Myanmar

From proximate analysis, moisture contents of flour A, B and C were 11.79%, 12.15 % and 12.85% respectively. This coincided with a report of Xue and Ngadi (2009) that found 12.67%

moisture content in the wheat flour. Fat content of flour B was 1.18%, while those of flour A and flour C were 0.95 and 0.86, respectively (Table 1). In general, fat content in flour should be not over than 1.5 % (Matz, 1960). In this study, ash content of all flour samples was in the same range (0.3-1.0 %) as reported by Xue and Ngadi (2009). However, fiber content of flour A (2.74%) was higher than those of flour B (0.73%) and flour C (0.77%). In contrast, the protein content of flour A (15.23%) was lower than those of flour B (35.22%) and flour C (31.12%). The protein contents of flour B and C were much higher than normal wheat flour (7.5 - 15 %). Therefore the commercial wheat flours B and C may be from the mixture of wheat flour and others (ie. gluten Flour with a high level of protein tended to have high water absorption because protein could be used to improve water absorption capacity. The absorption capacity of flour protein could maintain the uniformity of dispersion. It possibly increased crispness of the fried product and produced a darker color (Klup and Loewe, 1990).

Regarding color, L* value of flour A was less than other samples. The a* value of flour C was lower than flour A and B, whereas its b* value was higher than other flours (Table 2). Variation of flour color may affect product color after frying.

Regarding pasting properties, peak viscosity of flour B and C were significantly ($P \leq 0.05$) higher than that of flour A. Trough viscosity was directly related to the peak viscosity. The combination between trough and breakdown value represented the peak viscosity. However, trough, final viscosity, breakdown and setback of flour A were significantly ($P \leq 0.05$) lower than those of flour B and C. Nonetheless, pasting temperature of all flour was not significantly different ($P > 0.05$). Variation of the pasting properties may affect the quality of the fried chicken due to variation in starch granules swelling and gelatinization during frying.

Table 1. Composition of wheat flour from Myanmar.

Content	Flour A	Flour B	Flour C
Moisture (% wb)	11.79^{c} ± 0.05	12.15^{b} ±0.05	12.85^{a} ±0.04
Fat (% db)	0.95^{b} ±0.06	1.18^{a} ±0.13	0.86^{b} ±0.17
Ash (% db)	0.21^{b} ±0.06	0.40^{a} ±0.12	0.43^{a} ±0.15
Fiber (% db)	2.74^{a} ±0.67	0.73^{b} ±0.40	0.77^{b} ±0.24
Protein (% db)	15.23^{b} ±0.13	35.22^{a} ±1.15	31.12^{a} ±5.18
Carbohydrate (% db)	69.08^{a} ±0.51	50.27^{b} ±1.49	54.17^{b} ±5.09

^{ac} mean within the same row with different letters are significantly different ($P \leq 0.05$)

Table 2. Color parameter of wheat flour from Myanmar.

Color parameter	Flour A	Flour B	Flour C
L*	93.06^{c} ± 0.04	94.07^{b} ± 0.01	94.58^{a} ± 0.30
a*	0.69^{a} ± 0.01	0.60^{b} ± 0.11	0.47^{c} ± 0.03
b*	7.82^{c} ± 0.65	8.30^{b} ± 0.02	9.29^{a} ± 0.02

^{ac} mean within the same row with different letters are significantly different ($P \leq 0.05$)

Table 3. Pasting properties of wheat flour from Myanmar.

RVA parameter	Flour A	Flour B	Flour C
Peak viscosity(RVU)	102.73^{c} ±1.24	157.73^{b} ±1.10	165.75^{a} ±1.38
Trough viscosity(RVU)	76.74^{c} ±2.76	104.70^{b}±0.26	113.17^{a} ±2.58
Breakdown (RVU)	25.99 ^{b} ±3.99	52.35^{a}± 0.85	52.58^{a} ±3.26
Final viscosity(RVU)	143.14^{c} ±3.25	183.05^{b} ±7.67	198.28^{a} ±0.74
Setback(RVU)	66.4^{b} ±5.87	78.35^{a} ±7.77	85.11^{a} ±1.84
Pasting temperature(^{o}C)	50.36^{a} ±0.31	50.48^{a}± 0.55	50.58^{a}±0.27

^{ac} mean within the same row with different letters are significantly different ($P \leq 0.05$).

3.2 Effect of Myanmar wheat flour types on quality of fried chicken

Variation of flour composition and properties did not significantly (P>0.05) affect the pickup and cooking loss during frying. All flour had 19.09 – 21.12 % pick up and 20.30 – 23.38% cooking loss. During frying, starch was gelatinized as well as water vapor was moved out from product.

That caused the cooking loss. At the same time, oil adhered to the surface and got into the inner part of the product (Duran *et al*., 2007). In this study, fat content in the crust of sample with flour C was the lowest ($P \leq 0.05$), compared with other two samples. The batter from the higher- protein flours absorbed more fat and retained less water during frying. There was a clear difference in fat absorption capacity (Klup and Loewe, 1990). Hardness of the fried chicken crust with flour A, B and C were 13.37 N, 12.80 N and 7.73 N, respectively. This was because the high protein flour tended to produce the coating with high brittleness and fragility of the fried coating (Kulp and Loewe, 1990). In addition, the high protein in flour could enhance browning reaction. As a result, L* of the crust of sample with flour C was less than flour A and B (Table 4).

Table 4. Variation of quality of the fried chicken.

	Flour A	Flour B	Flour C
Pick up % (%)	$21.12^{a} \pm 1.42$	$21.12^{a} \pm 2.71$	$19.09^{a} \pm 0.35$
Cooking loss (%)	$20.30^{a} \pm 3.21$	$23.88^{a} \pm 0.34$	$22.12^{a} \pm 2.26$
Fat content of fried chicken crust (%)	$30.81^{a} \pm 1.86$	$30.66^{a} \pm 2.02$	$27.12^{b} \pm 0.53$
Hardness of fried chicken crust (N)	$13.37^{a} \pm 1.60$	$12.80^{a} \pm 1.07$	$7.73^{b} \pm 0.67$
L* of fried chicken crust	$44.55^{a} \pm 0.68$	$42.23^{b} \pm 0.57$	$40.05^{c} \pm 1.43$
a* of fried chicken crust	$12.15^{a} \pm 1.60$	$12.41^{a} \pm 0.30$	$12.54^{a} \pm 0.68$
b* of fried chicken crust	$25.62^{a} \pm 3.39$	$27.27^{a} \pm 1.21$	$27.92^{a} \pm 0.65$

^{ac} mean within the same row with different letters are significantly different ($P \leq 0.05$).

Liking scores of the fried chicken from 3 wheat flours were presented in Table 5. All samples had the same level of liking scores on crust color ($P>0.05$). Although the coating pick up of all samples was not significantly different. However, liking scores on thickness of crust of samples with flour B and C were significantly ($P \leq 0.05$) higher than that with flour A. For crispness, sample with flour B had the highest liking score ($P \leq 0.05$) although sample with flour C had the lowest hardness. For the overall liking score, samples with either flour A or flour B had the highest score in the range of moderately like.

Table 5. Liking score of fried chicken with Myanmar wheat flour.

	Flour A	Flour B	Flour C
Thickness of crust	6.90^{b} ± 1.12	7.51^{a} ± 0.93	7.06^{a} ± 1.11
Yellow color of crust	7.69^{a} ± 1.10	7.66^{a} ± 0.98	7.48^{a} ± 1.00
Crispness of crust	6.81^{b}± 1.42	7.33^{a} ± 1.13	6.57^{b} ± 1.58
Overall liking	7.03^{ab} ± 1.01	7.42^{a} ± 0.93	6.84^{b}± 1.46

^{ab} mean within the same row with different letters are significantly different ($P \leq 0.05$).

Conclusion

Wheat flour in Myanmar had variation in composition particularly protein content and pasting properties. Flour with the high protein level tended to produce product with high crispness, dark color and high oil absorption. According to the quality analysis, flour A and B had potential to develop the dry mix for the fried chicken with the high liking score. Therefore, it is possible to use the local wheat flour in Myanmar. However, it needs to further compare with the imported wheat flour regularly used in commercial, in order to approve its application.

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