Comparison of Quality and Immunity between Thai Native and Crossbred Pigs in Colostrum and Milk

การเปรียบเทียบคุณภาพและภูมิคุ้มกันของน้ำนมเหลืองและน้ำนมของสุกรพื้นเมืองไทยและลูกผสม

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บทคัดย่อ: สารอาหารในน้ำนมเหลืองและน้ำนมมีผลต่อการเจริญเติบโตและการมีชีวิตรอดของลูกสุกรในระยะดูดนม วัตถุประสงค์ของการศึกษานี้เพื่อประเมินคุณค่าทางอาหารและภูมิคุ้มกันของนมน้ำเหลืองและน้ำนมของแม่สุกรพันธุ์พื้นเมืองไทยและสุกรลูกผสม โดยทำการเก็บตัวอย่างจากแม่สุกรพันธุ์พื้นเมืองไทย 18 ตัว และแม่สุกรลูกผสม 17 ตัว (ลาร์จไวท์xแลนด์เรซ) ซึ่งมีลูกสุกรพันธุ์พื้นเมือง 184 ตัว และลูกสุกรพันธุ์ผสม 229 ตัว ทำการเก็บข้อมูลการเจริญเติบโต อัตราการเจริญเติบโตต่อวัน และอัตราการตายในช่วงระยะดูดนม ทำการชั่งลูกสุกรที่อายุ 7, 14 และ 21 วัน การเก็บตัวอย่างนมน้ำเหลืองและน้ำนมจากแม่สุกรโดยการรีดจากเต้านมในเวลาที่ 0, 6, 12, 24, 48 และ 72 ชั่วโมงหลังคลอด นำมาใช้ในการวิเคราะห์ ปริมาณของแข็งทั้งหมด โปรตีนรวม เถ้า ปริมาณแลคโตส ไขมันรวม และอิมมูโนโกลบูลินชนิดจี (IgG) การตรวจวัดปริมาณ IgG ในนมน้ำเหลืองโดยใช้เทคนิค ELISA จากผลการทดลองแสดงให้เห็นว่าการเจริญเติบโตและอัตราการเจริญเติบโตต่อวันของลูกสุกรพันธุ์พื้นเมืองไทย (69.33 ก./วัน) ต่ำกว่าลูกสุกรพันธุ์ลูกผสม (167.67 ก./วัน) (P<0.01) อัตราการตายในช่วง 0 ถึง 24 ชั่วโมงหลังคลอดของลูกสุกรพันธุ์ลูกผสมต่ำกว่าลูกสุกรพันธุ์พื้นเมืองไทย (3.38% และ 5.70%) แต่อัตราการตายในช่วง 24 ชั่วโมงถึง 3 วัน กลับพบว่าลูกสุกรพันธุ์ลูกผสม (6.51%) มีค่าสูงกว่าลูกสุกรพันธุ์พื้นเมืองไทย (1.11%) ส่วนคุณภาพและส่วนประกอบของทั้งสองสายพันธุ์พบว่าปริมาณโปรตีนรวม ปริมาณของแข็งรวม และปริมาณเถ้า ในนมน้ำเหลืองของแม่สุกรพันธุ์พื้นเมืองไทยและสุกรพันธุ์ลูกผสมไม่มีความแตกต่างกันทางสถิติ แต่อย่างไรก็ตามปริมาณไขมันรวมและปริมาณแลคโตสมีความแตกต่างกันตามระยะเวลา (P<0.001) โดยปริมาณไขมันรวมของพันธุ์ลูกผสมมีปริมาณสูงกว่าพันธุ์พื้นเมืองไทยอย่างมีนัยสำคัญที่เวลา 48 และ 72 ชั่วโมง (P<0.05) และ มีความแตกต่างในสายพันธุ์เดียวกันเมื่อเวลาเพิ่มขึ้น (P<0.001) ปริมาณของแข็งทั้งหมดของน้ำนมสุกรพันธุ์ลูกผสม (26.83%) มีค่าสูงกว่าน้ำนมของสุกรพันธุ์พื้นเมือง (23.91%) ที่ 0 ชั่วโมง (P<0.001) ส่วนปริมาณ IgG ในนมน้ำเหลืองของสุกรพันธุ์พื้นเมืองสูงกว่าสุกรพันธุ์ลูกผสมที่เวลา 24 และ 48 ชั่วโมง (95.75, 66.97 และ 70.79, 32.96 มก./มล ตามลำดับ) (P<0.001) และพันธุ์พื้นเมืองมีปริมาณสูงกว่าพันธุ์ลูกผสมที่เวลา 72 ชั่วโมง (P<0.05) ส่วนการวิเคราะห์ความสำพันธุ์ระหว่างอัตราการเจริญเติบโตในช่วง 7 วันหลังคลอดกับส่วนประกอบและคุณภาพของน้ำนมไม่พบความสำพันธ์กัน กล่าวโดยสรุปอัตราการเจริญเติบโตของลูกสุกรมีผลมาจากสายพันธุ์ และคุณภาพของน้ำนมของทั้งสองสายพันธุ์แตกต่างกันตามระยะเวลาหลังจากการคลอด

คำสำคัญ: นมน้ำเหลือง สายพันธุ์ ภูมิคุ้มกัน โภชนะ

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Abstract: Nutrition content in colostrum and milk are affected to the growth performance and survival of the piglets during lactation. The objective of this study was to evaluated quality and immunity of colostrum and milk between Thai native (TN) compared with crossbred (CB) pigs. The colostrum and milk from 18 TN and 17 CB (Large White x Landrace) pigs were determined to quality and immunity, and their piglets (184 piglets of TN and 229 piglets of CB) were estimated the growth performance, ADG, and mortality during sucking period. Piglets were weighed at birth and 7 days of age. Colostrum and milk from sows were collected manually across all teats at 0, 6, 12, 24, 48, and 72 hours, and were used to analysis for total solids, crude protein (CP), ash, lactose, crude fat (CF), and IgG concentration. IgG concentration in colostrum was measured by ELISA technique. Results showed that the growth performance and ADG of TN (69.33 g/day) piglets was lower than CB (167.67 g/day) piglets (P<0.001). The mortality rate during 0 to 24 hours after farrowing of CB piglets was lower than TN (3.38% and 5.70%), but the mortality rate during 24 hours to 3 days after farrowing of CB (6.51%) piglets was significantly higher than TN (1.11%) piglets (P<0.001). For the composition and quality of all two breeds: CP, lactose, and ash concentration were not significantly different by breed (P>0.05). However, CP and lactose concentration were significantly different by over time within the breed (P<0.001). The CF concentration of CB was significantly higher than TN at 48 and 72 hours (P<0.05), it was also significantly different within the same breed when the over time (P<0.001). The CF concentration of TN was significantly different within the same breed as the CB when the overtime (P<0.001). The total solids of CB (26.83%) was significant higher than TN (23.91%) at 0 hour (P<0.001), but the IgG concentration of TN was significantly higher than CB at 24 and 48 hours (95.75, 66.97 and 70.79, 32.96 mg/ml, respectively) (P<0.001), and TN (32.50 mg/ml) was also significantly higher than CB (20.56 mg/ml) at 72 hours (P<0.05). For the correlation between growth performance of piglets during 7 days after farrowing and composition and quality of colostrum and milk was not significantly different. These results showed that the growth performance of the piglets was affected by breed. For the composition and quality of colostrum and milk of TN and CB had significantly different within over time after farrowing.

Keywords: Colostrum, breed, immunity, nutrition

Introduction

The number of piglet production at weaning per year is defined to be efficiency of sow productivity (Kikuchi *et al*., 2002). In 2014, there were 9,504,921 pigs in Thailand, and 8,000,244 pigs were crossbred and 580,881 pigs were Thai native (Swine Producers and Processors for Exporting association, 2014). Thai native pigs can adapt well to hot and humid climates, tolerate low quality feed, and disease resistant (Rattanaronchart, 1994).

Certain Thai native pig breeds offer promise for improvement of their performance for economically important traits with European commercial breeds (e.g. Duroc; DR, Large White; LW, Pietrain), and disease resistance and environment improvement to reduce mortality rate (Chaiwatanasin *et al*., 2002). Survival and satisfactory growth of piglets are highly dependent on colostrum intake from the sows (Quesnel *et al*., 2012). At the birth, new-born piglets have low energy reserves and devoid of immune protection

(Le Dividich *et al*., 2005; Farmer *et al*., 2006), and the first feed in the first life day of piglets is colostrum from sows (Milon *et al*., 1983). Colostrum from the sow was provided energy, nutrition, and immunoglobulin source which essential crude protein for the growth factor, energy balance, productive maternal antibodies, other disease resistance factors during lactation to after weaning, and protection from the infection of newborn piglets until their own immune system was mature, but among of colostrum yield and IgG concentration in sows were varied greatly (Ferrari *et al*., 2014; Klobasa *et al*., 1987). The yield of colostrum were averaged 3.22 ± 0.34 kg per sow and 11.7 to 101.4 g/L of IgG in colostrum at the first day (Foisnet *et al*., 2010). Amount 200 g of colostrum ingestion provides passive immunity to piglets, reducing their risk of death before weaning and affording them increase weight gain (Ferrari *et al.,* 2014), inadequate of colostrum intake of piglets is a major cause of low hypothermia and hypoglycemia, and inadequate of colostrum intake is insufficient intake maternally derived immunoglobulin, particularly immunoglobulin G (IgG) which is available in large quantities in colostrum during the first 3 day after farrowing (Foisnet *et al*., 2010), and its effected to morbidity, mortality, growth, and future productivity of piglets (Rooke and Bland, 2002; Le Dividich *et al*., 2005).

Previously, there were many studies had been undertaken analyzing the effects of breed on swine colostrum quality and immunity in piglets. However, there had been limited research on native pig breed in the northern Thailand. Thus, the major aim of this study was to determine quality and immunity of colostrum between Thai native and crossbred pigs in northern Thailand.

Materials and Methods

This experiment was conducted at the Demonstrative and Training Swine Farm, Department of Animal and Aquatic Sciences, Faculty of Agriculture, Chiang Mai University. A total of 18 Thai native (TN), and 17 Large white x Landrace (crossbred, CB) sows and their piglets (184 piglets of TN and 229 piglets of CB) were used to this experiment. The first 12 weeks of gestation, sows were fed 2 kg/day, and during the last 4 weeks 3 kg/day (contain 14% CP; 0.53% Lysine, 3,190 kcal ME/kg). A farrowing, sows were fed as the same feed formulate, but among of feed intake were according to the number of litter size. Sows had free access to fresh water. The farrowing process was induced on day 114 of gestation with 1 ml of prostaglandins (Cloprostenol Sodium) received 2 ml of oxytocin (2 ml of a 10 IU/ml solution; General Drugs House Co., Ltd) by intramuscular route. Piglets were weighted at birth after onset farrowing and 7 days of age to estimate the difference of growth performance, average daily gain (ADG), and mortality between Thai native and crossbred piglets during three days after birth. For the mortality was collected at birth after onset (0 hour) to 24 hours and 24 hours to 3 days.

The sample of colostrum and milk were collected manually across all teats 5-12 ml at 0, 6, 12, 24, 48 and 72 hours (date of birth was defined as day 0 of age) and storage at -20 ^{o}C. Colostrum and milk samples were analyzed for total solid, ash, crude protein (CP) and crude fat (CF) by AOAC 2006. Total solid was determinate by drying overnight at 60 ^{o}C, ash was by incineration and determining the weight of the ash remaining, CP by the Kjeldahl method, and CF by Soxhlet apparatus and the milk lactose content was determined by

high-performance liquid chromatography coupled to reflective index defector (RID). The milk sample preparation modified by Chavez-Servin *et al.* (2004) for analysis sugar was added approximately 1.0 ml ethanol-water (1:1, v/v) into 2.5 ml of raw colostrum or milk and stirred. After mixing completely then added 250 µl Carrez I solution and followed with 250 µl Carrez II solution. After that added 5 ml of acetonitrile (HPLC-grade; RCILabscan, Thailand) for precipitate the CP and non-sugar fraction and left 1-2 hours until complete precipitation of CP clot. Filtered through filter paper (Whatman), passed through a C18 Sep-Pak. Then, filtered again by 0.45 µm nylon filters and injected into the HPLC system (Shimadzu, Shimadzu Corporation, Kyoto, Japan). This was equipped with a LC-10AD pump, CBM-10A system controller and RID-10A refractive index detector coupled to a computer with class LC10 controller software. An Inersil NH_2 column (5 um, 250x4.6 mm) (GL Science Inc., Japan) was used, mobile phase was 85:15 of acetonitrile:water (RCI Labscan, Thailand), flow rate 1 ml/min, with an oven temperature of 40 ^{o}C (Chuttong *et al*., 2016).

For immunoglobulin G (IgG) determination, colostrum and milk were centrifuged for 10 min at 14,000 rpm, and then diluted to 1:10,000 in PBS. IgG concentration in colostrum and milk was evaluated by enzyme linked immunosorbent assay (ELISA) and modify method from Devillers *et al*. (2004). The 96-wells plates were coated with 100 µl of rabbit anti-pig IgG (whole molecule) 7.8 ng in 0.05M sodium bicarbonate solution (pH 9.6) and incubated overnight at 4 ^{o}C. The plate was washed 3 times with washing buffer. Afterward add 200 µl PBS containing 1% BSA and incubated for 1 hour at room temperature (RT). Thereafter, the plate washed by washing buffer 3 times. Adding 50 µl with diluted samples and standard (pig IgG) into duplicate wells and incubated for 1 hour at RT. And then the plate was washed 3 times with washing buffer. Each well was add with rabbit anti-pig labeled peroxidase 20 µl and incubated for 1 h at RT. After that, the plate washed again with 3 times washing buffer. Then, add the substrate OPD 50 µl and the colored reaction was stopped by 50 µl 4 M H_2SO_4 and read absorbency at 492 nm. Finally, the standard curve calculated for the sample. Intra-assay in this determination was 8.9% and Inter-assay was 12.2%.

In term of the statistical method, data were analyzed using the procedure of SPSS Windows. All statistical tests were performed with SPSS Statistics 17.0 (SPSS Inc., Chicago, IL). For the analysis of growth performance, piglets were weighed from birth to weaning and the average daily gain (ADG), mortality, composition and IgG in colostrum and milk were calculated. The observed mean between breeds was used Student's *t*-test comparisons. For the observed mean on in multiple comparisons was based on the Duncan Post Hoc test.

Results and Discussion

Growth performance and mortality rate

Thai native (TN) and Crossbred (CB) pigs were difference on growth performance, average daily gain, and mortality in pre-weaning period presented in Table 1. The body weights of all treatments at the first week of age were increased, but body weight and ADG of TN piglets was significantly lower than CB (P<0.001). In our study, birth weight of TN piglets were lower than CB piglets (0.65 ± 0.15 and 1.43 ± 0.20 kg, respectively), and TN piglets were also lower growth potential than CB piglets similar as the report of Skok *et al.* (2008). Their results showed that heavy piglets on birth weight were still heavier at the end of lactation in

Table 1. Body weight and average daily gain (ADG) of piglets in sucking period

Item	Thai native	Crossbred
Number, sows	18	17
Number, piglets	184	229
Litter size at birth, heads	10.22	13.47
Litter weight at birth, kg	6.64	19.26
Feed intake of sows during gestation period, kg	258	258
Feed intake of sows during sucking period, kg	63-147	94.5-178.5
Body weight, kg		
Birth weight	0.65 ± 0.15	1.43 ± 0.26**
7 days	1.12 ± 0.15	2.66 ± 0.26**
ADG (g/day)		
7 days	69.33 ± 23.05	167.67 ± 34.8**
Mortality, %		
During 0 to 24 hours	5.70 ± 8.51	3.38 ± 5.12
During 24 hours to 3 days	1.11 ± 4.71**	6.51 ± 5.8

Value correspond to means ± SE of two breeds

Student's *t*-test comparisons at the same time between breeds are shown by asterisks:

** $P<0.001$

comparison to light piglets. Vaclavkova *et al*. (2012) showed that the low birth weight piglets were growth lower than piglets with higher birth weight, also low birth weight piglets had gain less all period of production and less longissimus muscle (Glinoubol *et al.,* 2016). In this research the ADG of CB (167.67 ± 34.81 g/day) piglets at the first week of age, it was found to be significantly higher than TN (69.33 ± 23.05 g/day) piglets ($P<0.001$). These finding were similar the reported by Decaluwe *et al.* (2014). Their research found the piglet's daily weight gain of crossbred at 3 and 7 days after birth and until weaning was 104 ± 3; 154 ± 3; and 205 ± 3 g/d, respectively, 150 to 160 g/day during lactation (McLaren *et al.,* 1987), 163.5 g/day in pre-weaning period (Woon *et al*., 2014). However, our data was different as reported by Gondret *et al.* (2005) found that ADG in suckling was 208 to 301 g/d, and 216 g/day from birth to weaning (Škorjanc *et al.,* 2007).

The mortality rate of TN piglets was higher than CB during 0 to 24 hours (5.70 ± 8.51% and 3.38 ± 5.12%, respectively). In contrast, during 24 hours to 3 days of CB piglets were higher than TN piglets (6.51 ± 5.83% and 1.11 ± 4.71%, respectively). The mortality rate of CB in this research was lower than reported of Decaluwe *et al*. (2014). Their study showed that the first 3 days after birth, the mortality rate of crossbred piglets was high to 85% and 11.6% of total pre-weaning period. The mainly cause of mortality was low birth weight than 1 kg and low colostrum intake less than 160 g/kg body weight. For the mortality rate of TN piglets was high at the first day of birth and less down after 3 days of age. Our data was not agreed with Nakai (2008) who studied the reproductive performance of native pig in the hillside of northern Thailand. The results showed that the pre-weaning mortality ratio was 16.4% and maximum was 44%.

Quality of colostrum and milk in sucking period

The colostrum and milk composition were observed between TN and CB sows throughout first 72 hours after farrowing of sucking period. The result was reported the amount of Ash, total solid, crude protein, crude fat, and lactose as show in Table 2.

The crude fat (CF) concentration in colostrum and milk of all breeds at beginning (0 hour) were increased from 4.56% to 8.26% of TN, and 4.20% to 11.39% of CB at 72 hours. Crude fat of CB at 48 and 72 hours (8.94 and 11.39%, respectively) were significantly higher than TN (6.47 and 8.26%; respectively) (P<0.05). The CF in first colostrum of TN and CB in this study were lower than another breeds, which were founded by Csapo *et al*. (1996). They reported that CF in first colostrum of Danish Large White, Danish Duroc, and Norwegian Landrace sows was 5.32%, 7.36% in Yorkshire and Meishan sow (Zou *et al*., 1992), 6.9% in Landrace x Large White (Foisnet *et al.,* 2010), and 8.9% in PIC (an imported five-way crossbred) sows (Decaluwé *et al*., 2013).

The ash of colostrum and milk concentration was not significantly different by breeds (P>0.05). It was also not significantly different within the same breed. The percentage of ash during 0 to 72 hours of TN was 0.58 to 0.63%, and 0.59 to 0.62% of CB. In our study was agreed with reported by Loisel *et al*. (2013) who investigated the effect of fiber intake during late pregnancy of sows on colostrum composition from the first piglet (0 hour) to 21 days of lactation, they reported the ash percentage value in colostrum and in milk was not influenced by treatments. Although the ash percentage value of TN and CB in here were lower than Dutch Landrace from 2 to 12 days after parturition 0.74% (Klaver *et al*., 1981), and lower than Yorkshire, Landrace, Lacombe, Duroc, Hampshire, Berkshire, and Large Black from 1 to 35 days of lactation period were 1.04% (Fahmy, 1972).

The total solids (TS) in colostrum and milk of CB (26.83%) was significantly higher than TN (23.91%) at 0 hour (P<0.01). For another times of two breeds were not significantly different (P>0.05).

Table 2. Composition of colostrum and milk in Thai native and crossbred

Item	0 hour	6 hours	12 hours	24 hours	48 hours	72 hours
Thai native						
Total Solids,%	23.91 ± 0.52	22.73 ± 0.52	22.95 ± 0.48	22.71 ± 0.48	22.00 ± 0.91	21.90 ± 0.45
Ash,%	0.63 ± 0.12	0.61 ± 0.14	0.53 ± 0.18	0.57 ± 0.15	0.47 ± 0.14	0.58 ± 0.20
Crude fat,%	4.56 ± 0.28^{bc}	4.01 ± 0.29^{c}	5.80 ± 0.54^{bc}	5.33 ± 0.35^{bc}	6.47 ± 0.68^{ab}	8.26 ± 0.85
Crude protein,%	18.47 ± 0.44^{a}	14.51 ± 0.38^{b}	14.49 ± 0.62^{b}	12.78 ± 0.37^{b}	9.69 ± 0.36^{c}	7.49 ± 0.46^{d}
Lactose, %	3.50 ± 0.32	3.67 ± 0.27	3.80 ± 0.36	4.03 ± 0.42	4.47 ± 0.7	4.52 ± 0.64
Crossbred						
Total Solids,%	26.83 ± 0.57**	23.83 ± 0.75	22.76 ± 0.66	22.35 ± 0.77	22.70 ± 0.75	22.91 ± 0.83
Ash,%	0.59 ± 0.06	0.56 ± 0.09	0.56 ± 0.13	0.55 ± 0.17	0.62 ± 0.12	0.53 ± 0.09
Crude fat,%	4.20 ± 0.82^{c}	4.21 ± 0.38^{c}	5.06 ± 0.87^{c}	6.39 ± 0.55^{c}	8.94 ± 0.54* $^{and\ b}$	11.39 ± 1.49* $^{and\ a}$
Crude protein,%	18.39 ± 0.41^{a}	14.95 ± 0.76^{b}	14.02 ± 0.36^{b}	13.13 ± 0.29^{b}	9.34 ± 0.16^{c}	6.99 ± 0.09^{c}
Lactose, %	3.22 ± 0.16^{d}	3.51 ± 0.23^{d}	4.05 ± 0.23^{cd}	4.19 ± 0.29^{bc}	5.82 ± 0.89^{ab}	6.25 ± 0.92^{a}

Value correspond to means ± SE of two breeds

Student's *t*-test comparisons at the column between breeds are shown by asterisks: * P<0.05; ** P<0.001

Means on the row carrying different superscript are shown significantly different between times in the same breed: $^{a, b, c, and\ d}$ P<0.001

The TS of CB and TN were high at 0 hour (26.83% and 25.16%, respectively), and then decreased until 72 hours (21.90% and 22.91%, respectively) after farrowing. Indeed, this result was agreed with the report by Klobasa *et al*. (1987). They studied the composition of colostrum and milk in German landrace sows during lactation and found that the TS was the highest at 0 hour (25.6%) after farrowing, and their concentration decreased approximately 30% during 24 hours (17.3%) after farrowing. But their result was higher than the result by Klaver *et al*. (1981). The milk composition and daily yield of different milk components as affected by sow condition and lactation. They found the TS in Dutch Landrace sows during 2 to 12 days after parturition was only 19.19%, and 19% of Yorkshire, Landrace, Lacombe, Duroc, Hampshire, Berkshire, and Large Black (Fahmy, 1972).

For lactose concentration in colostrum and milk during lactation between TN and CB sows was not significantly different by breed ($P>0.05$), but lactose of CB was significantly different with time during lactation period ($P<0.01$). The lactose of TN and CB sows were increased at each consecutive collection time during 0 hour after farrowing to 72 hours of lactation. The highest lactose in colostrum and milk of TN and CB sows was at 72 hours (4.52 and 6.25%, respectively), and the lowest lactose in colostrum and milk of TN and CB sows was at 0 hour (3.50 and 3.22%, respectively). This present experiment is ageed with report by Klobasa *et al.* (1987). They studied to the composition of colostrum and milk in German landrace sows during lactation. Their result found that the lactose concentration of milk sows was increased from 0 hour to 14 days (3.1 to 5.9%), and Yorkshire genotype was greater lactose than Belgian Landrace/Petrain and Duroc sire lines from 0 to 18 days (Farmer *et al*., 2006). Devillers *et al.* (2004) found lactose concentration changes around parturition in colostrum of multiparous sows. They showed that the ratios of lactose concentration in colostrum varied with time. Colostrum was lower lactose concentration than milk. The characteristic of colostrum composition was rapidly changed to milk during 24-30 hours after farrowing (Le Dividich *et al.,* 2005).

Total crude protein (CP) in colostrum and milk during lactation between TN and CB sows was not significantly different by breed ($P>0.05$), but it was significantly different with time during lactation period ($P<0.01$). The CP of TN and CB sows were decreased at each consecutive collection time during 0 hour after farrowing to 72 hours of lactation. The highest CP in colostrum and milk of TN and CB sows was at 0 hour (18.47 and 18.39%, respectively), and the lowest CP in colostrum and milk of TN and CB sows was at 72 hours (7.49 and 6.99%, respectively). This result was similar with the report by Fahmy (1972) and Zou *et al*. (1992), which observed in seven breeds (Yorkshire, Landrace, Lacombe, Duroc, Hampshire, Berkshire, and Large Black), the percentage of CP from colostrum to milk was dropped sharply from 17.3% to 5.47%. However, total CP in colostrum of TN and CB in here was higher than seven breeds (17.3%), Landrace x Large White (16%) by Foisnet *et al*. (2010), German Landrace (15.7%) by Klobasa *et al*. (1987), and lower than PIC sow (25.2%) by Decaluwé *et al.* (2014). Bourne and Curtis (1973) studied to the immunoglobulin system of the suckling pig. Their result showed that the high CP concentration in colostrum was high concentration of immunoglobulin which mothers transferred of passive immunity to their neonatal (Milon *et al*., 1983). Quesnel *et al*. (2012) and Devillers *et al*. (2007) reported that the consumption of 200 g of colostrum per piglet during

the first day after birth significantly reduced the risk of mortality before weaning, while the consumption of 250 g of colostrum was an indicator of good health and pre-weaning and post-weaning growth among piglets.

Immunoglobulin of colostrum and milk during lactation

IgG concentration contained in colostrum and milk of TN and CB were difference during pre-weaning period presented in Table 3. The IgG concentration in colostrum of TN and CB was the highest at 0 h (after onset of farrowing was located as 0 hour) (284.95 ± 30.10 and 316.15 ± 36.62 mg/ml, respectively), and their level was decreased rapidly by the time over (Figure 1). But the decreasing of IgG concentration in colostrum during lactation of TN was slow, when compared with IgG concentration in colostrum of CB. These observation partially were agreed with the results of Klobsa *et al.* (1987) in which the highest IgG concentration in colostrum at the onset of farrowing, and then decreased rapidly by the time over (Rooke and Bland, 2002), but our data of all two breeds was higher than the result by Klobsa *et al.* (1987) (95.6 mg/ml in German landrace sows), and higher than the result by Foistnet *et al*. (2010). Their research showed that the IgG concentration in colostrum was averaged 74.2 ± 6.1 mg/ml at the onset of farrowing.

Table 3. Concentration of immunoglobulin G in colostrum and milk during lactation period

Items, hours	Immunoglobulin G, mg/ml	
	Thai native	Crossbred
0	284.95 ± 8.05	316.15 ± 14.95
6	207.70 ± 9.01	196.75 ± 12.32
12	141.40 ± 5.23	137.22 ± 4.12
24	95.75 ± 1.65 **	70.79 ± 4.95
48	66.97 ± 2.08 **	32.96 ± 1.67
72	32.50 ± 6.34 *	20.56 ± 0.86

Value correspond to means ± SE of two breeds

Mean between breeds are shown by asterisks: * $P<0.05$; ** $P<0.001$

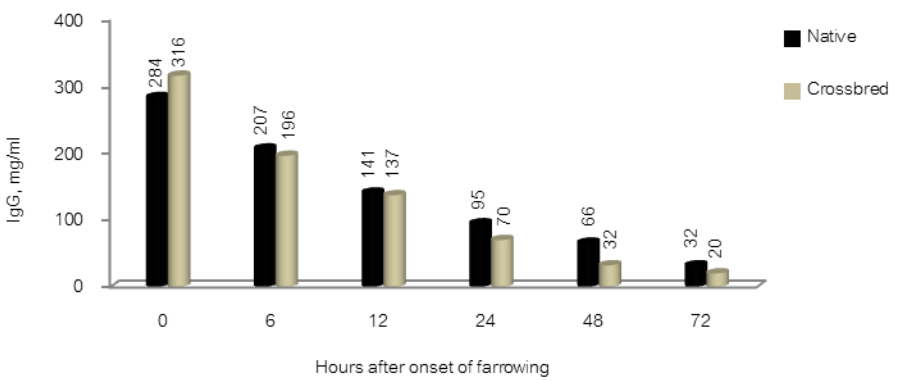


Figure 1. Colostrum and milk concentration of IgG after onset of farrowing between Thai native and crossbred sows (mean)

The IgG concentration in colostrum between TN and CB sow was significantly different by breeds. The IgG of TN was significantly higher than CB at 24 and 48 hours (95.75 ± 1.65 and 70.79 ± 4.95, and 66.97 ± 2.08 and 32.96 ± 1.67 mg/ml, respectively) (P<0.001), and the IgG of TN (32.50 ± 6.34 mg/ml) was also significantly higher than CB (20.56 ± 0.86 mg/ml) at 72 hours (P<0.05). This result was similar with the report by Farmer *et al*. (2006) and Simmen *et al*. (1990) studied the influence of genotype on colostrum and the milk composition of primiparous sows (Belgian Landrace, Duroc, Landrace and Yorkshire). They found that colostrum and at day 2 milk from Duroc sows contained more protein and lesser amounts of lactose than sows of other genotypes. The first colostrum samples contained 16.65% total protein, and during the first 6 h after farrowing the IgG accounted for nearly all the protein in the colostrum (Klobasa *et al*., 1987). The high protein content in colostrum was largely produced by the immunoglobulin G (Csapo *et al*., 1996). Devillers *et al*. (2007) and Quesnel *et al*. (2012) reported that the consumption of 200 g of colostrum per piglet during the first day after birth significantly reduced the risk of mortality before weaning, while the consumption of 250 g of colostrum was an indicator of good health and pre-weaning and post-weaning growth among piglets.

Correlation between composition and quality of colostrum and milk and the growth performance of piglets

The correlation between composition and quality of colostrum and milk and the growth performance of TN and CB piglets was shown in Table 4. The correlation between growth performance of all two breeds and composition and quality of colostrum and milk were not significantly different (P>0.05). The percentage correlation between growth performance of TN piglets to CP and lactose were very low (-0.25%), but it was high with IgG (0.63%). For the percentage correlation

Table 4. Correlations between growth performance of piglet and composition and quality of colostrum and milk

Item	Crude protein, %	Total solid, %	Ash, %	Crude fat, %	Lactose, %	IgG, %
Thai native						
Growth performance, g	-0.025	0.160	0.211	0.066	-0.084	0.630
Crude protein, %		0.247	0.150	0.117	-0.041	0.163
Total solid, %			0.248	0.040	0.241	0.131
Ash, %				-0.467	0.147	0.328
Crude fat, %					-0.153	-0.266
Lactose, %						-0.318
Crossbred						
Growth performance, g	0.075	0.106	-0.105	-0.018	0.072	-0.212
Crude protein, %		-0.076	-0.398	-0.069	-0.354	-0.398
Total solid, %			-0.531	-0.063	-0.283	0.438
Ash, %				0.164	0.274	-0.172
Crude fat, %					-0.272	-0.670
Lactose, %						0.225

between growth performances of CB piglets to Ash and IgG were very low (-202%), but it was high with total solid (0.106%). This result was different with the report by Lewis *et al*. (1978) determined the relationship between composition of sows' milk and weight gains of nursing pigs. They found that the mean efficiency of conversion of milk to gain was found to be 4.5 g of milk per 1 g of pig gain.

Conclusion

The growth performance and survival of TN and CB piglets during sucking period were affected by breed. The composition and quality of colostrum and milk between TN and CB can be concluded that the CP, lactose, and ash concentration were not significantly different by breed ($P>0.05$). However, CP and lactose concentration were significantly different by over time within the breed ($P<0.001$). The CF, total solids, and IgG were significantly different by breed. The CF concentration of CB was significantly higher than TN at 48 and 72 hours ($P<0.05$), it was also significantly different within the same breed when the over time ($P<0.001$). The CF concentration of TN was significantly different within the same breed when the overtime as the CB ($P<0.001$). The total solids of CB was significant higher than TN at 0 hour ($P<0.001$), but the IgG concentration of TN was significantly higher than CB at 24 and 48 hours ($P<0.001$), and was significantly higher than CB at 72 hours ($P<0.05$). For the correlation between growth performance of piglets during 7 days after farrowing and composition and quality of colostrum and milk was not significantly different ($P>0.05$). These results showed that the composition and quality of colostrum and milk of TN and CB had significantly different within over time after farrowing.

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