

Effect of feeding different levels of jaggery filter cake on blood biochemical and mineral profile in Yorkshire pigs

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ABSTRACT

Jaggery filter cake (JFC) is a good unconventional source of energy as well as minerals. An experiment was conducted using 30 Large White Yorkshire piglets (3 ½ month old), randomly divided and maintained on 5 dietary treatment groups, viz. group 1, concentrate only; group 2, concentrate +250 g JFC; group 3, concentrate +500 g JFC; group 4, concentrate +750 g JFC and group 5, *ad lib.* JFC only to observe blood biochemical and mineral profile. Jaggery filter cake supplementation was increased in the ratio of 50: 100: 150 g in group 2, 3, 4 respectively, every fortnight during growing stage and every week during finishing stage. To study the biochemical parameters, blood samples were collected at 0 day, 61st day and 121st day of feeding trail. The plasma glucose concentration of group 1, 2, 3, 4 and 5 ranged from 87.68 to 93.88 mg/dl. Glucose concentration was increased at the end of finishing stage as compared to growing stage in all the treatments. A significant ($P<0.01$) difference was found between group 2 and 3 and group 3 and 4. Plasma total protein value did not show any trend in the subsequent growing stage and finishing stage. Plasma A: G ratio ranged from 0.66 to 0.71 which did not differ significantly between different treatment groups. A: G ratio increased in all the treatment groups and control. Thus, supplementation of JFC along with concentrate or sole feeding of JFC did not affect plasma biochemical parameters and did not cause any adverse effect on the mineral profiles.

Key words: Jaggery, Mineral, Pig, Plasma, Yorkshire

In the recent past, demand of maize in poultry diet has increased that hiked its price and warrants for the alternative to replace maize with other easily available and cheaper source of energy which may be suitable for feeding to pig. Many researchers (Sikka 2007 and Campos *et al.* 2006) have tried to replace the maize with molasses also. Hence, alternate feed materials are constantly searched and most of the researchers are focusing on economical pork production using various agro-industrial byproducts (Kumaresan *et al.* 2007, Suresh 2007 and Suma *et al.* 2007). Jaggery filter cake (JFC) is obtained from jaggery preparation units. Scum is being removed from the boiling juice by a simple perforated scoop on a long handle. The solid material remained in the cloth is called as JFC and locally also referred as *maili*. JFC contains 4253.86 Kcal/kg of gross energy. The value of iron, zinc, copper, manganese, sodium and potassium was 3729.30, 468, 76.63, 198.65, 1718.33 and 8380 ppm respectively. Feeding

such high energy and mineral source will not only help in growing fast but also reduce the cost of production. On perusal of literature we have found few references on effect of feeding of sugarcane filter cake/press mud on biochemical and mineral profiles in different livestock (Suresh 2007 and Suma *et al.* 2007). JFC is also good source of mineral (Patel *et al.* 2009). However, no literature is available on JFC feeding on blood biochemical parameters. Therefore, the present study was conducted to observe blood biochemical and mineral profiles changes in Large White Yorkshire grower piglets fed on different level of *Jaggery filter cake* along with balanced diet.

MATERIALS AND METHODS

The experiment was conducted at Swine Unit, Department of Livestock Production and Management, College of Veterinary and Animal Sciences, Pantnagar, Uttarakhand during the month of December 2007 to April 2008. A total of 30 LWY piglets of nearly 3 to 3.5 months ages having similar body weight were selected for the study. All the piglets were de-wormed 15 day before the start of the experiment with Albendazole. All animals were vaccinated against swine fever. The piglets were randomly divided into 5 treatment

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groups, as follows:

	Group 1	Group 2	Group 3	Group 4	Group 5
Jaggery filter cake	No JFC	250g*	500*	750*	<i>Ad lib</i> #
Standard balanced ration	<i>Ad lib.</i>	<i>Ad lib.</i>	<i>Ad lib.</i>	<i>Ad lib.</i>	No feed

* JFC increased @ 50: 100: 150 g every fortnight in 2, 3, 4 group, respectively, in growing stage and every week during finishing stage.

Vitablend @ 0.25g/kg feed; salt @ 0.5% and Mineral mixture @ 2% of feed on DM basis was added daily.

Standard balanced ration was prepared at the experimental site. The C.P. content of growing and finishing ration was 20.50 and 18.15% respectively. However, required portion of fresh JFC in calculated quantity was offered first and it was ensured that pigs have consumed completely before offering balanced ration. The grower ration was continued for 9 weeks (nearly up to 35 kg body weight). Subsequently all animals were shifted to finisher ration and it was continued for another 7 weeks.

In order to study the biochemical parameters in the plasma, blood samples (approximately 5 ml) were collected aseptically from the ear vein /anterior venacava in sterilized disposable syringes (24 gauge needle) at 0 day, 61st day and 121st day of feeding trial. Collected blood samples were transferred to heparinized centrifuge tubes and centrifuged at 3000 rpm for 10 min for separation of plasma. Plasma was stored at -20°C till the estimation of different biochemical parameters. However, glucose estimation was done immediately after harvesting plasma.

Estimation of glucose (mg/dl) was done by enzymatic GOD-POD method with the help of Span Diagnostic Kit at 505 nm wavelength against blank reagent (Sacks 1999). Cholesterol concentration in plasma was estimated spectrophotometrically using diagnostic kit with enzymatic method at 505 nm wavelength (Tietz 1998). Total protein concentration in plasma was estimated by Biuret method with the help of diagnostic kit at 540 nm wavelength (Johnson *et al.* 1999). Albumin concentration in plasma was estimated by standard method (Johnson *et al.* 1999). The albumin content was deducted from total protein to calculate globulin and expressed in g/dl. Albumin-globulin ratio was calculated by dividing globulin from albumin content.

Plasma samples were digested as per procedure described by Kolmer *et al.* (1951). Final volume of the digested sample was made up to 25 ml with de-ionized triple glass distilled water after lukewarming of the solution.

Atomic absorption spectrophotometer (AAS) was used for the estimation of zinc, iron, copper, and manganese. Stock solutions for different minerals were prepared by taking readymade standards commercially. Plasma concentrations of sodium and potassium were estimated by Flame Photometry method. A mixed standard for sodium and potassium was used. The data were analyzed using ANOVA with CRD design and the CD was calculated to determine

any significant difference among the treatments (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

The plasma glucose concentration of group 1, 2, 3, 4 and 5 ranged from 87.68 to 93.88 mg/dl (Table 1). Glucose concentration was increased in group 2, 4 and 5 but there was no statistical significant difference between different treatments during 0 day of experiment. Further, glucose concentration was increased at the end of finishing stage as compared to growing stage in all the treatments. A significant ($P < 0.01$) difference was found between group 2 and 3 and group 3 and 4. Plasma total protein concentration before start of experiment ranged from 6.40 to 6.91 g/dl. However, no significant difference was found between the treatments. Plasma total protein value did not show any trend in the subsequent growing stage and finishing stage. Plasma A: G ratio ranged from 0.66 to 0.71 which did not differ significantly between different treatment groups. A: G ratio increased in all the treatment groups and control. There was no particular trend in cholesterol concentration (mg/dl) both during growing and finishing stage. Data indicated that supplementation of JFC along with concentrate or sole feeding of JFC did not affect plasma biochemical parameters. Neog *et al.* (2003) also concluded that no significant difference in average values of all the blood constituents in crossbred (Hampshire × Assam local) pigs, fed two levels of energy 100% and 85% of standard energy level with or without enzyme supplement. This is also supported by Fashina and Fanimo (1994), who studied the effect of feeding 33, 67 and 100% sweet potato meal (SPM) as a replacement for maize in a soybean based diet for pigs. In the study, serum glucose had increased at 33 and 67% levels while serum cholesterol had increased at 67 and 100% SPM levels.

The Cu value ranged from 0.58 to 0.66 µg/ml in the beginning of the experiment which fell under the normal range (Table 2). At the end of growing stage, increment in the Cu value in each and every group was observed. However, relatively, the values are more in JFC fed groups. Such increment also occurred at the end of the experiment in group 1 and 2, but did not differ significantly. The Mn value in the beginning of the experiment was relatively more than the normal value. These values increased marginally in all of the treatments with advancement of experiment i.e. growing stage, but did not differ significantly. The Zn value before

Table 1. Blood biochemical constituents of pigs at different stages

Parameters	G 1	G 2	G 3	G 4	G 5
<i>Initial stage (0 day)</i>					
Glucose (mg/dl)	87.67±3.06	90.52±3.67	87.83±3.47	93.88±3.69	88.41±4.30
Total protein (g/dl)	6.40±0.03	6.91±0.21	6.80±0.20	6.48±0.11	6.80±0.13
Albumin (g/dl)	2.67±0.01	2.67±0.14	2.75±0.03	2.76±0.04	0.72±0.02
Globulin (g/dl)	3.72±0.02	4.41±0.26	4.02±0.21	3.83±0.083	3.83±0.07
A : G ratio	0.71±0.01	0.66±0.03	0.67±0.04	0.72±0.01	0.69±0.02
Cholesterol (mg/dl)	187.78±0.73	188.15±1.85	187.47±1.59	188.48±2.18	188.22±0.81
<i>Growing stage (61 day)</i>					
Glucose (mg/dl)	91.82±6.41	85.43±4.33	96.00±4.67	90.78±8.29	83.10±4.55
Total protein (g/dl)	6.49 ^{ab} ±0.10	6.54 ^{ab} ±0.13	6.72 ^a ±0.12	6.93 ^a ±0.21	6.21 ^b ±0.19
Albumin (g/dl)	4.30±0.07	4.37±0.07	4.50±0.13	4.50±0.19	4.06±0.15
Globulin (g/dl)	2.18±0.14	2.17±0.08	2.22±0.06	2.44±0.23	2.21±0.18
A: G ratio	2.01±0.15	2.02±0.07	2.03±0.09	1.93±0.24	1.94±0.20
Cholesterol (mg/dl)	193.41±4.91	177.15±4.11	184.20±6.31	177.13±3.08	191.32±8.82
<i>Finishing stage (121 day)</i>					
Glucose (mg/dl)	99.12 ^{abc} ±2.59	95.84 ^{ac} ±3.84	107.96 ^b ±2.76	98.15 ^c ±4.94	93.17 ^c ±0.78
Total protein (g/dl)	6.13±0.18	6.92±0.11	6.67±0.21	6.90±0.25	4.99±0.15
Albumin (g/dl)	3.93±0.12	4.07±0.13	4.10±0.06	3.98±0.14	3.48±0.13
Globulin (g/dl)	2.20 ^a ±0.27	2.81 ^b ±0.14	2.57 ^{ab} ±0.18	2.92 ^b ±0.24	1.49 ^c ±0.11
A: G ratio	1.94 ^{ab} ±0.32	1.53 ^a ±0.13	1.63 ^a ±0.11	1.41 ^a ±0.15	2.39 ^b ±0.20
Cholesterol (mg/dl)	175.60±4.43	170.08±4.70	179.19±5.90	172.11±14.81	174.82±2.76

^{a b c} Means bearing different superscripts in a row differ significantly from each other (P<0.01).

Table 2. Plasma mineral profile of pigs at initial, growing and finishing stage of experiment

Parameters	G 1	G 2	G 3	G 4	G 5
<i>Initial stage</i>					
Copper (µg/ml)	0.66±0.04	0.61±0.06	0.65±0.01	0.58±0.02	0.64±0.06
Manganese (µg/ml)	0.32±0.03	0.32±0.05	0.34±0.02	0.30±0.03	0.33±0.07
Zinc (µg/ml)	2.52±0.08	2.50±0.12	2.54±0.11	2.56±0.08	2.60±0.12
Iron (µg/ml)	5.96±0.11	6.14±0.65	6.51±0.44	6.14±0.64	6.36±0.21
Sodium (mEq/L)	196.63±18.48	202.21±9.07	192.14±11.15	200.82±14.24	193.48±11.16
Potassium (mEq/L)	11.76±0.39	12.30±0.48	11.80±0.37	11.93±0.10	11.63±0.35
<i>Growing stage</i>					
Copper (µg/ml)	0.81±0.04	1.07±0.09	1.14±0.04	1.1±0.04	1.32±0.05
Manganese (µg/ml)	0.52±0.07	0.68±0.03	0.52±0.07	0.91±0.07	0.57±0.09
Zinc (µg/ml)	1.87±0.09	2.39±0.15	2.17±0.09	2.58±0.06	2.97±0.01
Iron (µg/ml)	5.63±0.46	5.79±0.68	2.76±0.45	3.91±0.17	6.44±0.81
Sodium (mEq/L)	182.42±4.81	172.67±1.81	189.24±0.86	183.09±5.47	174.41±1.29
Potassium (mEq/L)	12.70±1.32	14.08±0.86	15.31±0.24	13.88±1.10	12.92±0.49
<i>Finishing stage</i>					
Copper (µg/ml)	1.27±0.06	1.37±0.13	1.02±0.04	0.67±0.05	0.87±0.04
Manganese (µg/ml)	0.38±0.04	0.56±0.08	0.57±0.11	0.67±0.10	1.05±0.06
Zinc (µg/ml)	2.96±0.20	3.02±0.13	2.57±0.05	1.94±0.11	1.92±0.10
Iron (µg/ml)	7.31±0.42	2.37±0.40	3.55±0.02	2.26±0.37	0.77±0.03
Sodium (mEq/L)	174.88±1.67	195.46±3.20	172.97±4.38	190.24±2.04	194.06±6.64
Potassium (mEq/L)	13.57±0.41	15.20±1.60	16.18±1.52	14.53±1.48	13.45±0.12

the experiment, mid of the experiment and at the end of the experiment ranged from 1.86 to 3.03 µg/ml which indicated that not much change in value from the beginning to the end of the experiment indicates that JFC feeding has not influenced the Zn. Results clearly indicates that JFC did not cause any adverse effect on the mineral profiles. The results are also in agreement with earlier findings (Budeppa 2004, Suresh 2004, Suma 2005). Further, inclusion of 2% mineral mixture probably might have taken care of the body requirement.

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