EFFECTS OF GREEN TEA GROUNDS ON PIG PRODUCTION AND MEAT QUALITY

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Objectives

The Japanese consume much tea and the amount of used tea leaves or "Grounds" comes to as much as 2,000 tons a year. The disposal of this residuum by burning or burying in to the ground leads to serious environmental problems. The authors have thus directed attention to converting used tea leaves into animal feed. Ground tea powder has been shown quite beneficial to health, in that it prevents tooth decay and has anti-cancer activity. Kuwano et al.(1989) in experiments on rats confirmed increased Ht, Hb and serum iron in the blood, protection from anemia and the promotion of fat metabolism. The present study was conducted the find means for preparing porcine feed from tea grounds and obtain better quality pork.

Experimental Methods

1.Green tea grounds   Tea grounds (Tea Fiber/Taiyo Kagaku, Japan) were used as fine tea powder residuum obtained by catechin extraction with hot water. Composition:moisture,5%; fiber,41%; protein,22%; glucide,12%; tannine,6%; lipid,5% and caffeine, at trace content.

2.Usage assessment   This parameter was determined based on pork production, health and nutritional value. Twenty piglets (body weight, about 67 kg) were divided into a trial group given formula feed containing 5% tea grounds by weight and a control group given only formula feed. These diets were administered 61days and the pigs were slaughtered at 197 days of age. During the feeding period, body weight and feed intake were measured to assess growth, weight gain and the usefulness of the tea residuum as a feed constituent. Blood samples were obtained weekly and analyzed for Ht, Hb, Fe, TP, Glc, T-cho, ALP, LDH and others. Collected excreta from the rectum was examined weekly for moisture, pH and ammonia content.

3.Pork quality   Quality assessment was made for left side of each carcass sample in terms of dressing percent, carcass length and rib eye area. Loin meat (*M. longissimus thoracis*, 24 hrs. postmortem) was examined for physicochemical characteristics such as pH, colour and meat chemical composition. Analysis of the chemical composition and processing quality of the meat were carried out using a cooked cured loin roll. The loin roll (24 hrs. postmortem) was cured with pickle for 2 weeks, smoked for 5 hrs. and cooked at an internal temperature of 65°C or above. The method of Scheffé (1952) was used for sensory evaluation by 50 girl students (age:18.5 years) as panel. The meat was scored as table meat or loin roll. The loin meat, dipped in boiling water for 10-15 seconds (Japanese "Shabushabu") and loin roll were compared for colour, odour, tenderness, flavour and total point evaluation scores. Cholesterol content in meat was determined by gas-chromatography using a fat extract-containing sample as the fatty acid component (Yamauchi,1988). Fatty acid composition was found by extraction, according to Folch et al.(1957) and gas-chromatography (Yamauchi,1988; Oshida,1984) following saponification and methylation.

Principal Results

1.Productivity of pigs   Meat production data are shown in Table 1. Body weight increase in the trial and control groups was 34.9kg and 38.1kg, respectively. The former group was inferior slightly to the latter group. Feed convertion ratios were 3.93 and 3.87, respectively.

2.Health and nutritional conditions   The items of anemia and nutritional conditions (TP, Hb, Ht, Fe), hepatic and nephric functions (BUN, ALP, GOT, GPT, LDH) and fatty metabolic functions (Glc, T-cho, TG, HDL) were observed with growth. There were no significant difference for each items between two groups(Table 2). This indicates that there is no special problem in health and nutritional conditions in the trial group.

3.Characteristics of excreta   The moisture and pH of excreta showed no change with growth in either group. Ammonia content was less in the trial than the control group.

Table 1. Productivity of pigs

Items	Trial	Control
Initial BW(kg)	67.8	67.2
Final BW(kg)	102.7	105.3
Live weight gain(kg)	34.9	38.1
Daily gain(g/day)	572	624
Feed conversion	3.93	3.87
Feed efficiency	0.25	0.26

4.Quality of pork   Carcasses macrofindings and quality were normal in all cases (Table 3). Physicochemical data are presented in Table 4. Both groups showed essentially the same colour scores based on the Pork Color Standard of Japan (1975), Hunter values and total heme content (myoglobin %). The results for sensory evaluation and statistical analysis are given in Tables 5 and 6. No significant differences in odour were evident in groups. In the results of sensory evaluation about other items, no significant difference was found between two groups.

5.Cholesterol content of meat   Cholesterol content was 24 mg and 28 mg for the trial and the control. The former group had 15% lower cholesterol than the latter.

6.Fatty acid compositions of meat   Fatty acid compositions are indicated in Table 7. Myristic acid, an im-

portant determinant of cholesterol content, was less in the trial gruop.

Table 2. Changes in blood constituents

Checking items (unit)	0 Trial	0 Control	2 Trial	2 Control	4 Trial	4 Control	6 Trial	6 Control	8 (weeks) Trial	8 Control
Body weight(kg)	67.2	67.2	78.8	79.4	87.6	90.0	96.8	98.3	102.7	105.3
TP(g/dl)	7.8	6.5	7.5	7.6	7.6	7.6	8.3	7.5	7.2	7.1
Hb(g/dl)	16.3	16.3	12.5	12.4	13.2	13.3	14.1	13.6	14.2	13.8
Ht(%)	38.6	40.5	38.0	39.0	38.9	39.2	40.5	38.5	39.9	39.1
Fe(μg/dl)	123	103	121	146	164	171	176	151	145	161
BUN(mg/dl)	28	22	37	39	41	47	47	43	42	36
ALP(IU/L)	266	248	231	294	234	279	268	284	183	193
GOT(IU/L)	22	20	20	21	18	17	25	16	18	16
GPT(IU/L)	27	26	24	29	27	31	33	31	27	27
LDH(IU/L)	575	489	532	518	593	545	637	466	504	453
Glc(mg/dl)	116	81	120	115	111	110	109	110	105	109
T-chol(mg/dl)	119	102	108	119	113	121	118	121	109	116
TG(mg/dl)	36	35	42	37	41	47	50	49	67	57
HDL(mg/dl)	28	33	37	38	42	45	39	37	36	35

IU/L: International unit

Table 3. Carcass quality

Items	Trial	Control
Final body weight(kg)	100.8	103.0
Carcass weight(kg)	68.1	71.4
Dressing percent(%)	67.5	69.3
Eye muscle area(cm²)	19.9	18.6
Back fat thickness(cm)	2.9	3.4

Table 4. Meat quality of pigs

Items	Trial	Control
Visual colour scores	4.3	4.1
Hunter L value	48.1	45.7
a value	18.3	18.9
b value	10.0	9.5
Total heme pigment(%)	0.06	0.06
pH	5.57	5.55
Moisture(%)	73.5	73.1
Water holding capacity(%)	85.7	86.8
Melting point(℃)Back	41.2	41.5
Abdominal	43.3	43.1

Table 5. Distribution of scores in sensory evaluation by paired comparisons [odour]

Scores / Combination	-3	-2	-1	0	+1	+2	+3	Total
A→B			11	5	7	2		25
B→A	1		7	11	4	2		25
Total	1	0	18	16	11	4	0	50

A:Trial. B:Control

Table 7. Fatty acid composition of meat(%)

Fraction		Trial	Control
C14:0	myristic acid	1.1	1.2
C16:0	palmitic acid	24.2	24.4
C18:0	stearic acid	11.7	12.0
C18:1	oleic acid	49.0	47.5
C18:2	linoleic acid	6.9	7.4
saturates/unsaturates		0.59	0.60
lipid content(g/100g)		3.89	3.84

Table 6. Analysis of variance in sensory evaluation by paired comparisons [odour]

Source	Sum of squares	d.f.	Mean square	F value
Main effects	1	1	1	0.038
Combination effects	0	0	0	—
Order effects	1	1	1	0.038
Error	52	2	26	
Total	54	4		

Conclusions
Green tea grounds may be used for the preparation of porcine feed resource, with consequent reduction in cholesterol content in pork and greater health benefit as food.

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