CHANGES IN LIVE-WEIGHT GAIN, BLOOD CONSTITUENTS AND WORM EGG COUNTS IN THAI NATIVE AND CROSS-BRED GOATS RAISED IN VILLAGE ENVIRONMENTS IN SOUTHERN THAILAND

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Summary

The aim of the present study was to investigate the effect of internal parasites on growth rates of Thai Native (TN) and crossbred (75% TN × 25% Anglo-Nubian, AN and 50% TN × 50% AN) goats (undrenched, drenched every 3 weeks or at 9 weeks) in village environments in southern Thailand in a humid tropical climate. There was no significant ($p > 0.05$) difference in growth rate ($g/kg^{0.75}/d$) between the genotypes during unsupplemented grazing (0-64 days of the experimental period). However, during supplementary feeding (64-127 days) and throughout the period (0-127 days) TN goats had significantly ($p < 0.01$) lower growth rates compared with 75% TN × 25% AN and 50% TN × 50% AN goats. There was no ($p > 0.05$) significant difference in growth rates between 75% TN × 25% AN and 50% TN × 50 % AN goats. The growth rates of goats drenched every 3 weeks were significantly ($p < 0.01$) higher than those undrenched or drenched at 9 weeks. The results of this study also indicate that drenching alone did not result in increased weight gain except when the nutritional status was also improved. Parasitic infection affected some blood constituents, such as pack cell volume, haemoglobin, total protein and albumin. This resulted in lower growth rates for control groups and goats drenched at 9 weeks compared to those of goats drenched every 3 weeks.

(**Key Words** : Thai Goats, Cross-breds, Live-weight Gain, Parasites, Village Environments)

Introduction

It is well known that crossbreeding indigenous or native goats with European breeds markedly increases the live-weight and/or growth rate of kids. The improved growth of cross-breds may arise initially from heterosis, and in the longer term, from an increased feed intake and feed conversion efficiency inherited from the European breeds. At the Prince of Songkla University (PSU), a Goat Research and Development Programme has been established with the objective of improving the productivity of Thai goats through improvement of the genetic potential and management. Preliminary results show that, under improved management, cross-bred (50% TN × 50% AN and 25% TN × 75% AN) kids had significantly higher preweaning growth rates ($g/kg^{0.75}/d$) than did 75% TN × 25% AN and Thai Native (TN) kids (Saithanoo et al., 1994). However, Pralomkarn et al. (1994c) found that there was no significant difference in the post-weaning growth rate (3-9 months of age) among TN and cross-bred goats. At the village level, Saithanoo et al. (1992) reported that TN kids had significantly higher pre-weaning growth rates (98.1 g/d) than those of 75% TN × 25% AN kids (73.0 g/d). However, the post-weaning production performance of goats with different genotypes in village environments has not been evaluated.

The objective of this study was to investigate the effect of goat genotype and internal parasites on growth rates of goats with different genotypes (0-50% AN) raised under village conditions.

Materials and Methods

Location and climate

The study was conducted in a village of Satun province, southern Thailand (5° 37′ N and 98 E) and involved 4 farmers. The region has a humid tropical

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climate with a mean annual rainfall of 1,337 mm, of which 73% falls between June and November. The mean maximum and minimum temperatures are 33.2℃ and 23.9 ℃, respectively.

Experimental design

A 3 × 3 factorial in randomized design was used. The factors were genotype (Thai Native, TN; 75% TN × 25% Anglo-Nubian, AN and 50% TN × 50% AN) and anthelmintic drenching (control, drenched every 3 weeks or drenched at 9 weeks).

Animals and their management

Thirty-six weaner bucks were used in this study. These goats were born at the Small Ruminant Research and Development Centre Research Farm during the period from March to April 1992 and weaned at 3 months of age. At weaning they were drenched with levamisole and niclosamide and vaccinated against: (i) caseous lymphadenitis (CLA), pulpy kidney disease, tetanus, black diseases, malignant oedema and black leg with Glanvac-6 vaccine (Commonwealth Serum Laboratories, Victoria, Australia), (ii) foot and mouth disease (Type A, O and Asia 1) and (iii) haemorrhagic septicaemia (Pagchong, Thailand). On 3rd September 1992, goats were brought to the village and they were allowed to graze on a five hectare paddock from 08:00 to 17:00 h daily. Water was freely available at all time. The experiment was run for 18 weeks starting on 17 September, 1992. No concentrate was supplied for the first 9 weeks of the experiment (17 September-19 November 1992). From 19 November 1992 onwards, concentrate was supplied at the rate of 300 g/d/goat. The concentrate consisted of (%) 25.0 palm kernel cake, 25.0 rubber seed meal, 25.0 maize or broken rice. 8.5 rice bran, 12.0 soybean meal, 2.0 oyster shell, 2.0 salt and 0.5 dicalcium phosphate. The concentrate contained 15.0% crude protein (DM basis). During the experimental period, animals were treated for health problems whenever necessary.

Anthelmintic treatment

On 3rd September 1994, all goats were treated with levamisole at the dose rate of 5 mg/kg body weight. After that goats in Treatment 2 were treated every three weeks and those in Treatment 3 were treated only once on 19 November 1992. Goats in Treatment 1 were kept as an untreated control group.

Measurements and sampling methods

Rainfall data was obtained from the Satun Animal Nutrition Research Station of the Department of Livestock Development, which is located about 14 kilometres from the experimental site. The total monthly rainfall (mm) during the experimental period was as follows: September, 280; October, 230; November, 108; December, 206 and January, 0.

All goats were weighed every 3 weeks. Faecal samples were also collected at the time of weighing from the rectum of each animal and stored at 4℃ until examination. Faecal egg counts were made by McMaster method (Whitlock, 1948) with a precision of 50 eggs per g of faeces (EPG).

Every three weeks, at the time of weighing, six goats from each genotype (2 from each drenching regime) were bled from the jugular vein into EDTA tubes for haematological analysis. Packed cell volume (PCV) was measured by the capillary microhaematocrit method. The haemoglobin and total leucocyte counts were measured by an Automatic Cell Counter (Baker 8000, US Summit, USA). The differential leucocyte counts (monocyte, lymphocyte, eosinophil, pre-mature neutrophil and basophil) were made on Wright-stained blood smears. The total serum protein and albumin were determined with an Auto-Analyzer (Hitachi-704, Boehringer Mannheim Ltd., Germany).

Statistical analysis

Data was analysed using the Statistical Analysis Systems Package (SAS, 1987). Comparisons of growth rates, blood constituents and faecal egg counts (after transformation by $\log_{10}(n + 1)$ of goats across genotypes and drenching regimes were made by analysis of variance (Steel and Torrie, 1960).

Results

Effect of genotype on growth rate

Table 1 shows the mean squares from analysis of variance of the growth rates of goats. There was no significant ($p > 0.05$) difference in growth rate between genotypes in the first period (0-64 days of the experimental period). However, in the second period (from 64-127 days) or the whole period (0-127 days), TN goats grew significantly ($p < 0.01$) slower than did 75% TN × 25% TN and 50% TN × 50% AN goats. There was no significant ($p > 0.05$) difference in growth rate between 75% TN × 25% AN and 50% TN × 50% AN goats. (table 1).

Effect of gastro-intestinal parasites on growth rate

Goats drenched every 3 weeks grew significantly ($p <$

0.01) faster than those in the undrenched (control) group or the 9 week-drenched group (table 2).

Table 3 shows the means of EPG of gastro-intestinal nematodes in goats under different treatments. After 3 weeks of the experiment, goats drenched every 3 weeks had significantly ($p < 0.05$) lower EPG counts than those in the other groups, except at week 12, when the EPG of goats drenched at 9 weeks dropped to the same level as those in the 3 week-drenched group. However, EPG of goats drenched at 9 weeks had significantly increased by week 15 (figure 1).

TABLE 1. MEAN SQUARES FROM ANALYSIS OF VARIANCE FOR GROWTH RATE

Source	df	Growth rate 0-9 weeks	9-18 weeks	0-18 weeks
Genotype (G)	2	7.086	57.397**	25.374**
Drenching (D)	2	14.267*	92.073**	35.539**
G × D	4	2.426	26.851*	8.098
Error	27	78.647	256.608	101.746

*$p < 0.05$, **$p < 0.01$.

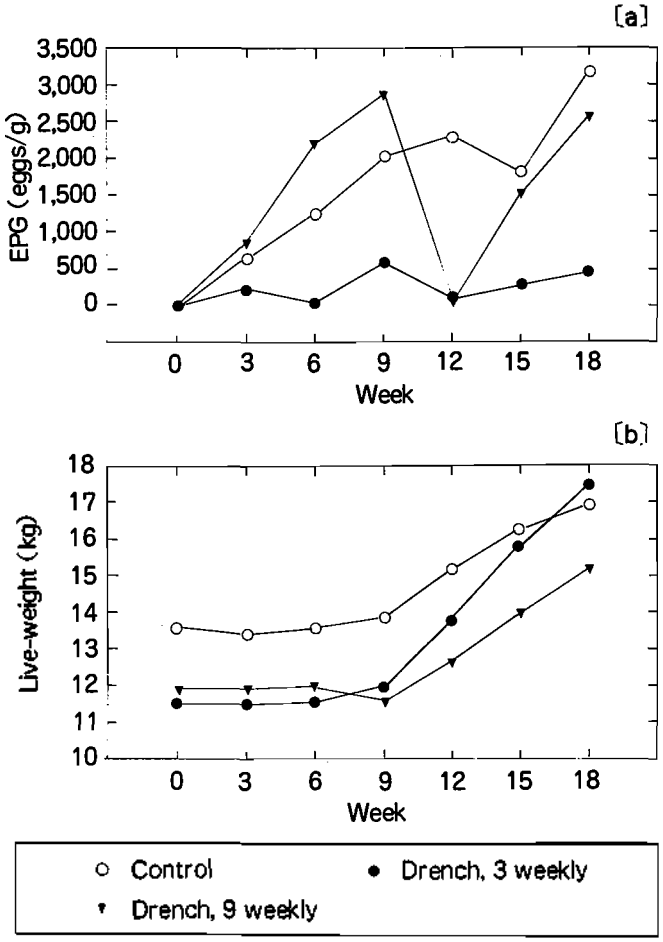

Figure 1. Mean total worm egg counts (EPG) (a) and mean live-weight (b) of three groups of goats with different drenching regimes.

TABLE 2. LEAST-SQUARE MEANS FOR GROWTH RATE (g / $kg^{.75}$ / d) OF GOATS WITH DIFFERENT GENOTYPES AND UNDER DIFFERENT ANTHELMINTIC TREATMENTS

	0-9 Weeks	9-18 weeks	0-18 weeks
Genotype			
Thai Native (TN)	−0.6±0.53	5.6±0.96[a]	2.5±0.60[a]
75% TN × 25% AN	1.1±0.57	10.2±1.03[b]	5.6±0.65[b]
50% TN × 50% AN	0.2±0.49	9.0±0.88[b]	4.6±0.55[b]
Drenching			
Control	0.4±0.62[ab]	5.4±1.12[a]	2.9±0.71[a]
3 weeks interval	1.1±0.50[a]	11.5±0.91[b]	6.3±0.57[b]
9 weeks interval	−0.9±0.45[b]	7.9±0.81[a]	3.5±0.51[a]

[ab] In each column under each effective factor, means with different superscripts differ significantly from each other ($p < 0.05$).

AN = Anglo-Nubian.

TABLE 3. MEAN OF EGG COUNTS PER GRAM OF FAECES OF GASTRO-INTESTINAL NEMATODES IN GOATS UNDER DIFFERENT TREATMENTS

Date	Control	3 weeks drenched	9 weeks drenched
17/09/92	0	0	0
09/10/92	661±173[a]	233± 41[b]	860±181[a]
29/10/92	1,250±150[a]	46± 18[b]	2,207±547[a]
19/11/92	2,022±459[a]	588±133[b]	2,883±609[a*]
09/12/92	2,289±356[a]	100± 44[b]	44± 14[b]
30/12/92	1,806±177[a]	279± 70[b]	1,537±323[a]
22/01/93	3,178±600[a]	454± 88[b]	2,567±346[b]

* Drenching time in 9-week drenched goats.

[a,b] Means in the same row with different superscripts differ significantly from each other ($p < 0.01$).

TABLE 4. MEAN VALUES OF SERUM GLOBULIN (g %) IN THREE GOAT GENOTYPES

Genotype	Weeks of experiment			
	3	9	12	18
Thai Native (TN)	4.67	3.65	3.28	3.70
75% TN × 25% AN	4.20	3.23	3.12	3.23
50% TN × 50% AN	4.00	2.90	2.68	3.17
E.M.S.@	0.02	0.16	0.08	0.08

Values with different superscripts in the same column differ significantly from each other ($p < 0.05$), @ error mean square
AN = Anglo-Nubian.

TABLE 5. RESULTS FROM ANALYSIS OF VARIANCE OF EFFECT OF PARASITIC INFECTION ON BLOOD CONSTITUENTS

	Weeks of experiment						
	0	3	6	9	12	15	18
Pack cell volume	NS	NS	**	*	NS	*	*
Haemoglobin	NS	NS	NS	*	NS	*	*
White blood cell	NS	NS	NS	NS	NS	*	*
Total protein	NS	NS	NS	NS	NS	NS	*
Albumin	NS	NS	NS	NS	NS	*	*

NS = not significant, * ($p < 0.05$), ** ($p < 0.01$).

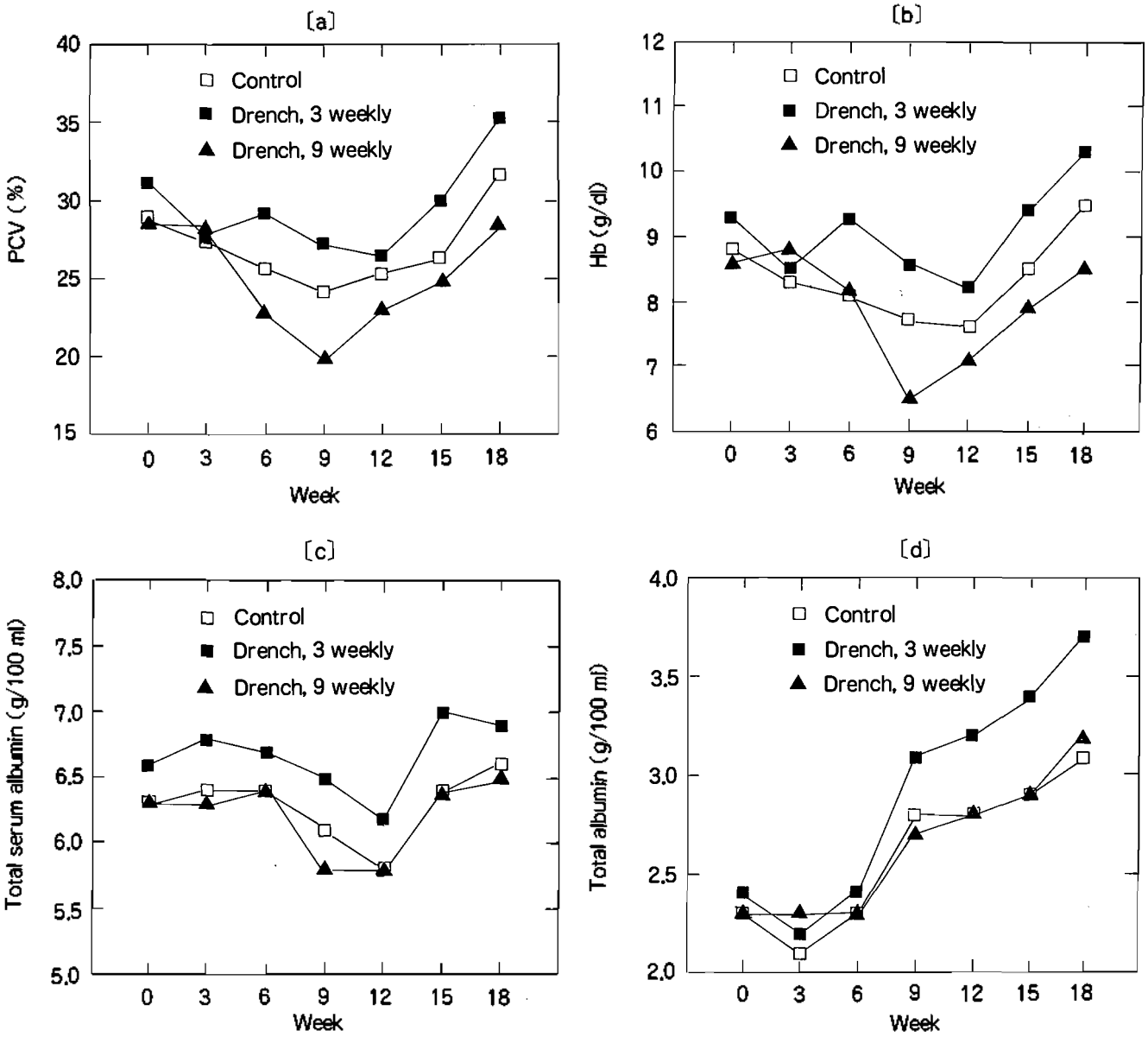

Figure 2. Mean packed cell volume (PCV) (a), haemoglobin (Hb) (b), total serum protein (c) and total albumin (d) of three groups of goats with different drenching regimes.

Effect of genotype on blood constituents

There was no effect of genotype on any blood constituents except globulin. TN goats had significantly ($p < 0.05$) higher total globulin in serum than did 50% TN × 50% AN goats at weeks 3, 9, 12 and 18 (table 4). However, there was no significant difference in total globulin between 75% TN × 25% AN and 50% TN × 50% AN at weeks 3, 9 and 18.

Effect of gastro-intestinal parasites on blood constituents

Table 5 shows the results of the analysis of variance of parasitic infection in some blood constituents. Figure 2 shows changes in PCV, Hb, total serum proteins and total albumins of goats in the control group and those drenched every 3 weeks and drenched at 9 weeks. The PCVs of goats in every treatment were reduced from the beginning of the experiment until week 9, when all goats received concentrate supplementation. They subsequently increased continuously to the end of the experimental period. From week 6 onward, treatment type significantly affected PCV values (except in week 12). Goats drenched every 3 weeks had the highest PCV values throughout. However, only at weeks 6 and 15 were PCV values of goats in 3 week-drenched group significantly higher than those for the control and 9 week-drenched groups.

At week 6, goats in the control group had significantly higher PCV than goats drenched at 9 weeks. In the later period, however, there was no significant difference in PCV values between goats in these two groups.

Parasitic infection significantly affected ($p < 0.05$) Hb concentrations at weeks 9, 15 and 18. Goats drenched every 3 weeks showed the highest Hb concentration, although the differences were statically significant only between goats drenched every 3 weeks and those drenched at 9 weeks.

Goats drenched every 3 weeks had significantly ($p < 0.05$) higher total serum protein at week 18 and had significantly higher albumin ($p < 0.05$) at weeks 15 and 18 than those in other treatments. There was no significant difference in total serum proteins and albumin between goats in the control group and those drenched at week 9.

There were no effects of parasitic infection on total globulin values or differential leucocyte counts.

Discussion

Effect of genotype on growth rate

This experiment was conducted in a village where goats grazed on native pasture which consisted largely of Alang alang (*Imperata cylindrica*), Pueraria (*Pueraria phaseoloides*) and a weed (*Eupatorium adoratum*). There was no significant difference in growth rate among the genotypes in the first period (−0.6, 1.1 and 0.2 g/kg$^{0.75}$/d for TN, 75% TN × 25% AN and 50% TN × 50% AN, respectively). TN kids lost weight during this period, but 75% TN × 25% AN and 50% TN × 50% AN kids gained weight. However, when goats were fed a concentrate supplement in the second period (64-127 days), TN kids had significantly lower growth rates (5.6 g/kg$^{0.75}$/d) than did 75% TN × 25% AN (10.2 g/kg$^{0.75}$/d) or 50% TN × 50% AN (9.0 g/kg$^{0.75}$/d). This finding is in agreement with those of Kochapakdee et al. (1993) and Pralomkarn et al. (1994b), who found that 50% TN × 50 % AN male weaners grazed on native pasture without concentrate supplementation only maintained their weight but gained weight substantially (63-91 g/d) when supplemented with concentrate (1.2% of body weight, B.W.).

Animals with high genetic potential will fully express their potential when an adequate environment is provided. The TN female goats (less than 2 years of age) grazed on improved pasture and, when offered about 1-1.2% B.W. of concentrate, gained 45 g/d (Milton et al., 1987). However, under improved management, no significant difference in post-weaning growth rate (3-9 months of age) (Pralomkarn et al., 1994c) or growth rate of female goats (1-2 years of age) (Kochapakdee et al., 1994) among genotypes was detected. The present study suggests in contrast that crossbred goats raised in villages could have better growth rates than those of natives when offered concentrate supplementation.

Effects of internal parasites on growth rate

At the beginning of the experiment, all animals had a low worm burden but after 6 weeks, the EPG of goats in the undrenched and 9 week-drenched groups increased to levels exceeding 1,250, and remained at this level throughout the experimental period, except for a dramatic decrease after drenching in the 9 week-drenched group. This result is similar to that of TN young female goats (< 1 year old) (Kochapakdee et al., 1991) and 50% TN × 50% AN male weaner (Kochapakdee et al., 1993) raised in a similar environment.

Three week-drenched goats were able to suppress their worm burden in this experiment. Drenching at week 9 allowed them to suppress their worm burden for only 3 weeks, after which EPG rose to the same levels as of those the undrenched group. These findings also agree with a study on sheep grazed in rubber plantation in North Sumatra, Indonesia, in which high EPGs were recorded 4-6 weeks after drenching (Carmichael, 1991). Rahman

(1991) and Kochapakdee et al. (1993) reported that in humid tropical environments, faecal egg counts were associated with total rainfall. Accordingly, goats were reinfested with internal parasites during the monsoon months (September-December).

In this study, there was an aberrant result in terms of the effect of gastro-intestinal parasites on growth rates of goats during the first 64 days of the experiment. However, in the subsequent period, when they were supplemented with concentrate, goats which were drenched every 3 weeks had significantly higher growth rates than did the control animals or animals drenched at 9 weeks. This may be due to a lower EPG of gastro-intestinal nematodes in the drenched group. Our finding agrees with that of Kochapakdee et al. (1993), who recommended that cross-breds raised under poor nutrition in villages would require a 4-6 week drenching to suppress parasitic burden. However, Pralomkarn et al. (1994c) found that under improved management conditions, where EPG of gastro-intestinal nematodes were low (< 848), there was no significant difference in growth rates between undrenched and monthly drenched goats. Such results may be due to the use of rotational grazing systems. The results in the present study indicated that goats raised in village environments would require drenching at less than 9 week intervals to suppress the parasitic burden. Nevertheless, it is suggested that drenching alone will not result in increased weight gain unless the nutritional status is also improved. In this region, 4 to 6 week drenching during the rainy season (April to November) and 8 to 10 week drenching from December to May have been recommended (Pralomkarn et al., 1994c).

Blood constituents

Under improved management there was no significant difference in blood constituents between control and drenched goats (Pralomkarn et al., 1994a). This may be due to a low EPG in goats under rotational grazing systems. In this study, from the beginning of the experiment up to 3 weeks, there was no significant difference in blood constituents, but parasitic infection affected PCV after 6 weeks and after 9 weeks in terms of Hb.

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