Ground *Acapulco* (*Cassia alata*) Seeds as Potential Dewormer for Native Chicken

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ABSTRACT

The study determined the anthelmintic efficacy of different dosages of ground *Acapulco* seeds (GAS) against intestinal parasites of native chicken at the poultry project of the Nueva Vizcaya State University.

Twenty-five parasitized native chickens were distributed to five intervention groups with five birds per group following non-randomization procedures of a quasi-experiment. The intervention groups were: Group 1 (IG_1) – commercial dewormer (Albendazole, Positive Control); Group 2 (IG_2) – non-medicated (Negative Control); Group 3 (IG_3) – 10 g encapsulated GAS; Group 4 (IG_4) – 20 g encapsulated GAS; Group 5 (IG_5) – 30 g encapsulated GAS. Observations and data collection were done at 3, 6, 9 and 12 days post treatment.

Results revealed that ground *Acapulco* seeds were effective against *Capillaria, Ascaridia* and *Tetrameres*. Necropsy findings showed that 20 and 30 g encapsulated GAS were more effective than albendazole in eradicating adult parasites. Use of encapsulated GAS as anthelmintic for native chicken reduced deworming cost.

INTRODUCTION

Intestinal parasitism is widespread in native chicken because of exposure to scavenging feeding systems. Chicken can pick up parasite eggs directly from contaminated feed, water, or litter or by ingestion of intermediate hosts like snails and earthworms. High concentrations of parasite eggs in scavenging environments play a major role in determining the severity of the infection in native chicken.

Presence of few parasites in native chicken does not usually cause problems, but large numbers can have detrimental effects on growth, egg production, and over-all health. Parasites compete for nutrient utilization, render birds less resistant to diseases, and exacerbate existing disease conditions. Poor growth and feed conversion, decreased egg production, and even death are important clinical signs of severe infections. Native chicken raisers, however, do not seriously implement efficient parasite control measures for the basic reason that commercial anthelmintics are expensive. Moreover, deworming expense is not compensated due to low flock productivity.

Potential dewormers like plant-derived anthelmintics, however, are available. Herbs, throughout history, have been utilized as medicines. Commonly referred to as herbals, these are often used in the treatment of many diseases and parasitism. Various plant parts like seeds, leaves, barks, flowers, fruits and roots are used as remedies for common diseases. Currently, growing interest in herbal medicine prompted many researchers to focus research endeavors toward the search for plant species with medicinal values.

One of the plants under consideration is *Acapulco* (*Cassia alata*), locally known as *Akapulko* (Tag.) or *Andadasi* (Ilk.) in the Philippines, *ringworm shrub* in India, and *candle tree* or *ringworm cassia* in Malaysia (Mootoka *et al.*, 2003). *Acapulco* is known for its antifungal property attributed to its chrysopanic acid content, a fungicide used to treat ringworm, scabies, eczema and other fungal diseases in man. It also contains saponin, a laxative that possesses anthelmintic activity and is useful in expelling intestinal parasites (Forsberg and Sachet, 1987). It has been used for soothing inflammation and shingles, as a skin disinfectant, for constipation, edema, herpes infections, hepatitis, liver discomfort, impetigo, worm infestation, as a laxative and an analgesic.

It is claimed to be effective against leprosy, for wound healing, for snakebites, bronchitis, asthma, as an antibacterial, and diuretic. It is also claimed in folk medicine as an effective anthelmintic or dewormer (Forsberg and Sachet, 1987). There is, however, a dearth of scientific evidence for their folkloric claim, particularly in native chicken.

This study therefore evaluated the efficacy of encapsulated ground *Acapulco* seeds (GAS) as anthelmintic against internal parasites of native chicken. Specifically, it aimed to: (1) determine the efficacy of different dosages of encapsulated GAS as dewormer for native chicken; (2) identify the genera of expelled helminths as a result of using different dosages of encapsulated GAS as dewormer,;and (3) assess the cost of deworming native chicken with encapsulated GAS compared to commercial anthelmintics.

MATERIALS AND METHODS

Three dosages of encapsulated ground *Acapulco* seeds (GAS) and 25 growing native chicken were used in the study. The birds were confined in laying cages for fecal collection. Collected fecal samples were placed in plastic bags. Lactophenol was used as clearing agent for helminths identification. Formalin was used as a preservative for parasites collected during necropsy.

Collection and Processing of *Acapulco* Seeds

Ripe matured pods with intact seeds were collected from *Acapulco* plants growing wild in the hills of Ibung, Villaverde, Nueva Vizcaya. After removal from the pods, seeds were sundried until brittle, then ground to powder form in a seed grinder. Ground seeds were sieved in a fine mesh strainer to remove debris and attain particle uniformity. Dosages of ground *Acapulco* seeds (GAS) were predetermined by weight at 10, 20, and 30 g portions with a digital balance. Each portion of GAS was then encapsulated in gelatin capsules.

Chemical Analysis of Ground *Acapulco* Seeds (GAS)

Two composite 100 g samples of GAS were prepared for qualitative and quantitative phytochemical analysis for components with anthelmintic properties. One sample was brought to Adamson University Technology Research and Development Center (AUTRDC) for saponin analysis. Alkaloid analysis was done at the National Institute of Molecular Biology and Biotechnology (BIOTECH), University of the Philippines at Los Baños, College, Laguna.

Procurement and Selection of Experimental Chicken

The experimental birds were purchased from a farmer who raised native chicken in a semi-confined-scavenging production system which exposed the birds to possible parasite infestation. Native chicken on the grower stage were selected being most susceptible to parasitism.

Research Design and Experimental Interventions

The experimental birds were assigned to five intervention groups with five birds per group making a total of 25 experimental units. Sampling followed the non-randomization procedures of a quasi-experiment. The intervention groups were designated as follows:

Group 1 (IG_1) – Albendazole (Positive Control)
Group 2 (IG_2) – Non-medicated (Negative Control)
Group 3 (IG_3) – 10 g encapsulated GAS
Group 4 (IG_4) – 20 g encapsulated GAS
Group 5 (IG_5) – 30 g encapsulated GAS

Administration of Encapsulated Ground *Acapulco* Seed (GAS)

Birds were fasted 12 hours prior to administration of GAS. Albendazole was administered following the manufacturer's recommendation.

Data Collection

Fecal samples were collected three consecutive days prior to administration of experimental interventions, and on the 3rd, 6th, 9th and 12th day of GAS administration, average egg count per gram (EPG) of fecal material was taken using the McMaster Technique. Presence of parasite eggs was determined using the Sugar Flotation Technique.

Post-treatment and Necropsy Evaluation

A sample bird from each intervention group was sacrificed for necropsy immediately after the 12th day of GAS administration. Each organ of the gastrointestinal tract (GIT) was thoroughly examined for presence of parasites.

Adult parasites collected from the fecal samples and from the organs of the gastrointestinal tract (GIT) were preserved in 10 percent formalin solution in properly labeled vials for proper identification of genera.

Other Observations

Time to worm expulsion, cost analysis, chemical analysis of GAS and behavior of the experimental birds were recorded.

Statistical Analysis

Quantitative data on number of adult parasites recovered at necropsy and interval between time of deworming administration and worm expulsion were statistically treated as frequency and means or averages.

EPG was statistically treated as counts and used in the determination of percent efficacy of encapsulated GAS against internal parasites of native chickens.

Efficacy of the deworming interventions against internal parasites was determined using the formula:

$$\%\ \text{Efficacy} = \frac{\text{Pre-Treatment EPG} - \text{Post-Treatment EPG}}{\text{Pre-Treatment EPG}} \times 100$$

Percent efficacy was matched with a standard set of criteria by Riek and Keith (1957) indicated below:

81–100%	reduction of EPG is highly effective
60–80%	reduction of EPG is effective
< 60%	reduction of EPG is ineffective

RESULTS AND DISCUSSIONS

Efficacy of Encapsulated Ground *Acapulco* Seeds (GAS) Against *Capillaria spp*.

Two dosages (10 and 30 g) of GAS with efficacy ratings of less than 60% (48.33 and 49. 09%, respectively), were ineffective against *Capillaria* parasites at 3 days post-treatment while Albendazole and the non-medicated intervention were highly effective. Obviously, the highly effective efficacy rating of Albendazole is expected since this is a synthetic preparation containing benzimidazole carbamate with a broad spectrum activity against helminths and even protozoa, hence, a more immediate effect. Conversely, GAS is a crude preparation based on natural phytochemicals like saponin (BIOTECH, 2010) and alkaloids (AUTRDC, 2010), which are known to possess anthelmintic properties.

Hypothetically, administration of anthelmintics reduces EPG counts at post-treatment. Actual number of *Capillaria* eggs from birds treated with 20 g GAS however, was ironically higher at 3 days, 6 days and 12 days post treatment compared to what were obtained during pre-treatment. This resulted in -572.73%, -81.82%, and -245.45% efficacy ratings during the abovementioned days, respectively. It was assumed that 20 g dosage is ineffective. This holds true with 30 g GAS with efficacy ratings of -72.73% and -10.91% during the 9th days and 12th days post-treatment, respectively (Table 1).

Analysis of the occurrence of negative efficacy ratings in 20 g and 30 g GAS dosages however confirmed that these dosage levels were not ineffective as previously assumed. Observed high egg counts (EPG) were attributed to lysis of killed worms. Lysis resulted in disintegration of cells and release of large numbers of eggs into the GIT (Liberty G. Torres, personal communication); hence, their inclusion in high EPG counts. The presence of killed parasites in the birds' GIT was assumed due to anthelmintic action of the foregoing GAS dosages.

On the other hand, killed *Capillaria* parasites were absent in the non-medicated group; hence lysis and expulsion of large number of eggs did not occur in birds assigned to this group. This resulted in highly effective efficacy rating. Higher number of live parasites recovered at necropsy of birds in the non-medicated group (Table 4) supports this contention.

Efficacy of 10-g dose of GAS against *Capillaria* progressed from an ineffective rating of 48.33% at 3-days to an effective rating of 78.33% at 6 days post-treatment. This was comparable to 60% efficacy rating of Albendazole but declined from 55% to 51.67% during the 9th and 12th days post-treatment, respectively. Dosage of 20 g GAS against *Capillaria* became effective with 72.73% efficacy rating at day 9 post-treatment, which was comparable to Albendazole with 64% efficacy rating.

While efficacy of other treatment groups tended to wane with time, 30 g dose of GAS was still effective at 12 days post-treatment, with efficacy of 78.18%. This dose was more effective than Albendazole whose anthelmintic effect waned at day 12 post-treatment. Ironically, despite its higher concentration of GAS, anthelmintic action of 30 g dose GAS

Table 1. Efficacy (%) of ground *Acapulco* (*Cassia alata*) seeds as dewormer against *Capillaria* in native chicken

Treatment group	Pre-treatment	Days post treatment							
		3		6		9		12	
		EPG	%	EPG	%	EPG	%	EPG	%
1 (Albendazole)	500	60	88.00	200	60.00	180	64.00	220	56.00
2 (Non-medicated)	1640	360	78.05	240	85.37	680	58.54	420	74.39
3 (10 g GAS)	1200	620	48.33	260	78.33	540	55.00	580	51.67
4 (20 g GAS)	220	1480	-572.73	400	-81.82	60	72.73	760	-245.45
5 (30 g GAS)	1100	560	49.09	1900	-72.73	1220	-10.91	240	78.18

became more effective at a later time, while lower doses that were effective earlier tended to decline with time.

Efficacy of some treatment groups regressed with time with a consistent trend especially with Albendazole and 10 g GAS, while those of 20 g and 30 g GAS were effective only at certain days after treatment, *i.e.*, days 9 and 12, respectively. The non-medicated group did not show any consistent trend which was expected since no drug has been administered to the test birds.

Efficacy of Ground *Acapulco* Seeds (GAS) Against *Ascaridia/Heterakis spp*.

Results show that 10 g GAS was highly effective against *Ascaridia/Heterakis* at day 3 post-treatment with an 83.10% efficacy rating (Table 2). Other doses (20 g and 30 g GAS) with 41.38% and 39.13% efficacy ratings, respectively, were ineffective against *Ascaridia/Heterakis* at day 3 post-treatment. Two doses (10 and 30 g) of GAS with 81.69% and 62.07% efficacy were rated highly effective and effective, respectively, against *Ascaridia/Heterakis* on day 6 post treatment. Other treatment groups had negative efficacy ratings as a result of high EPG at post-treatment compared to pre-treatment counts.

Albendazole tended to be ineffective against *Ascaridia/Heterakis* at days 3, 6 and 12 post-treatment. However, negative ratings were again attributed to higher EPG counts at post-treatment as a result of lysis of killed worms and release of large number of egg from lysed parasites, and not necessarily through oviposition. Presence of killed worms which later were lysed is an efficacy indicator for an anthelmintic. Except at day 9 post-treatment, this observation was consistent with Albendazole up to day 12 post-treatment. This assumption holds true with 30 g dosage of GAS, but not with the non-medicated group, which also showed negative efficacy ratings. Undoubtedly, negative ratings in the non-medicated groups can be attributed to the expulsion of a large number of eggs. Expulsion of a large number of eggs however was not attributed to lysis of killed worms since no anthelmintic was given to birds in this group; instead this was attributed to oviposition of large number of eggs by live parasites in the GIT of experimental birds (Table 4).

None of the interventions seemed to be effective against *Ascaridia/Heterakis* at days 9 and 12 post-treatment suggesting that efficacy of the different anthelmintics against *Ascaridia/Heterakis* was short-lived. However, if presence of killed and lysed parasites and high EPG counts at post-treatment are considered efficacy indicators, then a 30 g dose of GAS could be treated as an effective dewormer against *Ascaridia/Heterakis* parasites from day 6 to 12 post-treatment.

The low efficacy ratings of the different dosages of GAS and the control interventions

Table 2. Efficacy (%) of ground *Acapulco* (*Cassia alata*) seeds as dewormer against *Ascaridia/Heterakis* in native chicken

Treatment group	Pre-treatment	Days post treatment							
		3		6		9		12	
		EPG	%	EPG	%	EPG	%	EPG	%
1 (Albendazole)	340	660	-94.12	420	-23.53	240	29.41	400	-17.65
2 (Non-medicated)	720	140	80.56	880	-22.22	1500	-108.33	440	38.89
3 (10 g GAS)	1420	240	83.10	260	81.69	1080	23.94	700	50.70
4 (20 g GAS)	580	340	41.38	220	62.07	400	31.03	460	20.69
5 (30 g GAS)	460	280	39.13	3700	-704.35	1620	-252.17	720	-56.52

Table 3. Efficacy of ground *Acapulco* (*Cassia alata*) seeds against *Tetrameres spp.* in native chicken

Treatment group	Pre-treatent	Days of post treatment							
		3		6		9		12	
		EPG	%	EPG	%	EPG	%	EPG	%
1 (Albendazole)	100	20	80.00	0	100.00	0	100.00	0	100.00
2 (Non-medicated)	0	0	0.00	20	0.00	0	0.00	0	0.00
3 (10 g GAS)	40	20	50.00	0	100.00	0	100.00	0	100.00
4 (20 g GAS)	140	20	85.71	40	71.43	40	71.43	0	100.00
5 (30 g GAS)	60	20	66.67	0	100.00	80	-33.33	0	100.00

observed at day 9 to 12 post-treatment are indicative of any of two reasons: (1) that *Ascaridia/Heterakis* parasites are resistant to the different interventions; or (2) that efficacy of the interventions particularly the different GAS dosages has waned with time.

Efficacy of Ground *Acapulco* Seeds (GAS) Against *Tetrameres spp*.

Observations showed that a 20 g dose of GAS was highly effective against *Tetrameres* parasites in native chickens at day 3 post-treatment. Findings showed that this particular dose gave an efficacy rating of approximately 87% which compared favorably with that of Albendazole with an efficacy rating of 80% (Table 3). Similarly, a 30 g dose of GAS resulted in an efficacy rating of approximately 67% which was equivalent to a descriptive rating of effective. At 10 g dose, GAS was ineffective against *Tetrameres* at day 3 post-treatment. Significant reductions in EPG were noted in all treatment groups at day 6 post-treatment. Efficacy ratings in all GAS treatments and Albendazole ranged from 71.43% to100% with descriptive ratings ranging from effective to highly effective (Table 3). These observations clearly demonstrate the effectiveness of

Table 4. Genera and number of adult parasites recovered from the GIT of native chicken at necropsy

Treatment groups	Genus	Number of parasites recovered from gastrointestinal organs				
		Proven-triculus	Small intestines	Large intestines	Ceca	Total
1 (Albendazole)	*Ascaridia/Heterakis*	0	7	0	2	9
	Tetrameres spp.	0	0	0	0	0
2 (Non-medicated)	*Ascaridia/Heterakis*	0	4	0	9	13
	Tetrameres spp.	58	0	0	0	58
3 (10 g GAS)	*Ascaridia/Heterakis*	0	2	0	10	12
	Tetrameres spp.	15	0	0	0	15
4 (20 g GAS)	*Ascaridia/Heterakis*	0	0	3	14	17
	Tetrameres spp.	0	0	0	0	0
5 (30 g GAS)	*Ascaridia/Heterakis*	0	6	0	0	6
	Tetrameres spp.	0	0	0	0	0

GAS as an anthelmintic against Tetrameres. Effectiveness of 10 g and 20 g doses of GAS was sustained through days 9 and 12 post-treatment with 100% efficacy ratings. At 30 g dose, GAS resulted in -33.33% efficacy rating at day 9, but this negative rating was not considered as an ineffectiveness of the dose since it registered a 100% reduction rating at day 12 post-treatment. The sudden increase in EPG was a result of lysis of worms that resulted in the expulsion of large numbers of eggs and their inclusion in egg counts.

Genera and Number of Adult Parasites Recovered at Necropsy

Pre-treatment EPG counts showed that the experimental birds were infected with internal parasites identified into three genera: *Capillaria*, *Ascaridia* and *Tetrameres*. Among these genera, *Ascaridia/Heterakis* and *Tetrameres* were recovered at necropsy conducted at the end of the experiment; no *Capillaria spp*. was recovered. Parasites were recovered from different regions of the gastrointestinal tract particularly from the proventriculus, small intestines, large intestines and ceca (Table 4).

Nine *Ascaridia/Heterakis* parasites were recovered from sample birds previously treated with Albendazole. Seven parasites were recovered from the small intestines and two from the ceca. Recovery of adult parasites from the GIT of treated birds implies that Albendazole has not completely eliminated the worms despite its highly effective efficacy rating.

A total of 13 *Ascaridia/Heterakis* and 58 *Tetrameres* parasites were recovered from birds in the non-medicated group. Most of these parasites were recovered from the proventriculus, ceca and small intestines. This is expected since birds in this treatment group were not treated with any dewormer hence, the greater number of recovered parasites.

Twelve adult *Ascaridia* and 15 *Tetrameres* parasites were recovered from sample birds that were treated with 10 g GAS. Out of this numbers, 15 were recovered from the proventriculus, two from the small intestines, and 10 from the ceca. On the other hand, 17 adult *Ascaridia* were taken from birds that were treated with 20 g GAS, where three were recovered from the large intestines, and 14 from the ceca. Only six adult *Ascaridia* parasites were recovered from the large intestines of 30 g GAS-treated sample birds. It is interesting to note that only *Ascaridia* parasites were recovered from 20 g and 30 g GAS-treated sample birds at necropsy. No *Capillaria* and *Tetrameres* parasites were observed and recovered at necropsy indicating a complete elimination of these parasites as an effect of administration of 20 g and 30 g dosages of GAS. On the other hand, the presence of recovered *Ascaridia* at necropsy reflects two possibilities like: (1) failure of the interventions to completely eradicate this parasite indicative of its high resistance against the dewormers that were used; and/or (2) efficacy of the interventions have waned with time.

Time Interval between Drug Administration and Worm Expulsion

No consistent intervals between time of drug administration and expulsion of adult parasites were noted among the different treatments (Table 5). A longer interval between time of drug administration and worm expulsion was observed among birds that were treated with 30 g and 10 g GAS with 187.6 minutes and 107.2 minutes, respectively. Shorter intervals between drug administration and worm expulsion were noted with birds treated with Albendazole and 20 g GAS with averages of 59 minutes and 82.4 minutes, respectively.

Observation on inconsistency of intervals between time of drug administration and worm expulsion did not guaranty the effectiveness of the control treatment and various dosages of GAS against internal parasites of native chickens. Though it was assumed that levels of GAS and time interval between drug administration and worm expulsion are linearly correlated, results proved otherwise.

Table 5. Time from drug administration to worm expulsion

Treatment group	Time of administration					Time of expulsion					Average number of minutes
	1	2	3	4	5	1	2	3	4	5	
1 (Albendazole)	8:05	8:08	8:13	8:17	8:20	9:20	8:36	10:08	9:02	8:52	59.00
2 (Non-medicated)	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0.00
3 (10 g GAS)	8:21	9:44	9:05	9:36	10:07	8:59	13:57	9:27	10:14	13:12	107.20
4 (20 g GAS)	9:00	8:32	9:20	9:13	10:02	9:19	8:55	12:20	10:10	12:15	82.40
5 (30 g GAS)	9:50	8:40	9:28	9:55	9:39	11:14	12:48	12:22	12:41	14:05	187.60

Cost Analysis

Comparative analysis of the four treatments groups showed that the use of albendazole resulted in the highest deworming cost. Use of alternative dewormer like ground Acapulco seeds (*Cassia alata*) resulted in cheaper deworming cost (Table 6). The cost incurred for Albendazole as dewormer was P0.50/bird or a total of P2.50 for the five samples that were used.

On the other hand, total costs incurred in deworming native chickens with GAS were the following: Dose 1 (10 g GAS) was P0.50, Dose 2 (20 g GAS) was P1.00 and Dose 3 (30 g GAS) was P1.50. The cost difference between Albendazole and 10 g GAS was P2.00, Albendazole and 20 g GAS was P1.50, and Albendazole and 30 g GAS was P1.00. Ground Acapulco seeds had comparable efficacy to Albendazole. However, it is cheaper as an indigenous dewormer.

Chemical Analysis of the Ground *Acapulco* Seeds (GAS)

Alkaloid and saponin are known to have anthelmintic properties. Upon analysis, alkaloid content of the GAS samples gave around a total weight of 1.3 mg or an equivalent of 0.0073%. On the other hand, saponin content was 2.66%.

Chemical analysis of GAS revealed the presence of 1.3 mg or anzz equivalent of 0.0073% alkaloids (BIOTECH, 2009) and 2.66% saponin (AUTRDC, 2009). Alkaloid and saponin are known to have anthelmintic properties. The presence of abundant saponin as well as alkaloids in almost all tissues of *Cassia alata* would probably explain its efficacy as an anthelmintic.

Behavior of the Experimental Birds

The behavior of the experimental birds during after the administration of dewormer was also observed and recorded. No adverse reactions and signs of toxicity were noted.

CONCLUSION AND RECOMMENDATIONS

Results of the study showed that ground *Acapulco* seeds (GAS) were effective anthelmintics against internal parasites of native chickens. Based on these findings, efficacy of these GAS dosages was comparable to that of Albendazole, which is a commercial dewormer. Necropsy findings however showed that 20 g and 30 g GAS were more effective in eradicating adult parasites compared to 10 g GAS and Albendazole. Moreover, GAS is cheaper than Albendazole; further, it is always available to native chicken raisers as the *Acapulco* plant grows in abundance locally. Use of GAS as an alternative dewormer for native chicken is a potential cheaper options. Further testing may be necessary.

Table 6. Cost analysis of commercial and herbal (*Cassia alata*) anthelmintics used in native chicken

Anthelm-intic	Quantity	Unit	Unit Cost	Cost of Anthelmintic/Bird	No. of Birds	Total Cost
Albendazole	0.10	ml	5.00	0.50	5	2.50
Ground Acapulco Seeds						
Dose 1	10.0	g	0.01	0.10	5	0.50
Dose 2	20.0	g	0.01	0.20	5	1.00
Dose 3	30.0	g	0.01	0.30	5	1.50

Assumptions:

1. Cost of one 30 ml bottle of Albendazole		P150.00
2. Cost of a kilogram of ground acapulco seeds		10.88
3. Cost per gram of ground acapulco seeds		0.01
a) Cost of collection/gathering of matured pods, drying, removal of pods	P9.38	
b) Cost of grinding	1.50	
c) Labor rate/day	150.00	
d) Labor rate/hour	18.75	
e) Number of minutes used in a collection, drying, etc.	30 min	(0.5 hr)
f) Number of minutes used in grinding	5 min	(0.1 hr)
g) Dose of albendazole/bird	0.10 ml	

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