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ON-FARM EVALUATION OF BROILERS FOR THEIR ADAPTABILITY AND PRODUCTIVITY AT SMALL HOLDER LEVEL IN BAHIR DAR CITY, ETHIOPIA

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ABSTRACT*:* Broiler introduction and adaptation trial was done at Bahir Dar city in the year 2011/2012. The major objective of the trial was to introduce broiler breeds in to the region and evaluate their performance at smallholder level. A total of 1100 day old chicks of Hubbard Classical breed were purchased from Debre Zeit Agricultural Research Center and transported to Bahir Dar. Each participant received, on average, 109 day old chicks and 400kg started and finisher feed. Brooding was done using electrical brooder. Finished broilers were sold live and in processed form after six weeks of age. The average weight old day old chicks was 45.5g. The average weight of birds at end of 1st, 2nd, 3rd, 4th, 5th and 6th weeks were 136g, 364g, 711g, 1174g, 1665g and 2092g, respectively. The average final weight was 2092g (ranged 1957g - 2216g). The average cumulative mortality was 4.8% (Ranged 1.9%-6.5%). The average daily feed intake and cumulative feed intake of each bird during the entire period was 99g and 4052g, respectively. The average FCR was 1.84. The partial budget analysis result indicated that broiler production was profitable with a net benefit of 10.75 Eth Birr/head and 19.3 EthiOpian Birr/kg, respectively. The result showed that participants who sold processed broiler meat fetched 8.6 Eth Birr/kg more than those participants who sold live birds. The survey result indicated that all participants were highly satisfied by the breed. According to the producers; the breed has paramount merit than other chicken breeds like; very fast growth, high meat production and short rearing period. The higher final body weight, the lower mortality, higher profitability and higher market demand revealed that broilers could be reared at small holder level in big cities like Bahir Dar. The result of the trial showed that actions should be taken to solve the prevailing constraint including; lack of day old chicks and quality feed. One of the main lessons we learned from this trial was that we need to improve access of inputs to small holder producers so as to make broiler production sustainable in the region.

Keywords: Broilers, Hubbard Classical, Small Holder Producers

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INTRODUCTION

The poultry sector constitutes a significant contribution to human livelihood and food security of poor households (Abdelqader, 2007). In Ethiopia chickens are the most widespread and almost every rural family owns chickens, which provide a valuable source of food and cash income (Tadelle, 2003). The total chicken population in the country is estimated to be 49.2 million; with native chicken representing 97.3% from it (CSA 2010/11). The production system is based mainly on scavenging where birds are allowed to scavenge for major parts or all of their feed (Tadelle and Ogle, 1996).

Similar to the national system, the major proportion (>95%) of chicken production in Amhara Region is a traditional sector from which almost the whole chicken meat and egg production is produced. According to CSA (2010/11); the total chicken population of the region is estimated to be 14.01 million, accounting to 27.9% of the national chicken population.

In Ethiopian, like many African countries, attempts have been made at various times to improve village chicken production systems through introduction of exotic chicken breeds (Alemu and Tadelle, 1997). Distribution layers and duals purpose breeds has been one of the livestock extension packages accomplished by the Regional Bureau of Agriculture since the last 20 years aiming at improving chicken production and productivity. Despite this huge distribution of exotic chicken breeds, the contribution (adoption rate) of improved chicken in the current production system of the region is believed to be very low mainly due to high mortality rate of chicks (Teklewold et al., 2006).

A recent study on the adoption of exotic chicken breeds in the highlands of Ethiopia indicated that adoption has been limited by a set of factors such as; lack of strong extension follow up, poor awareness of chicken producers towards improved husbandry practices, lack of complimentary inputs, seasonal disease outbreak, lack of appropriate breed, unavailability of credit services, seasonal feed shortage and marketing problems (Tekelewold et al., 2006). In addition to the above constraints; lack of alternative chicken breeds like broilers has been one of the

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major problems which limit the supply and availability of chicken meat in the Region. Currently there are few commercial poultry farms involved in production and of broilers only in and around Addis Ababa area.

Every big hotels and super markets found in Bahir Dar city also had no any opportunity to get broiler meat inside the region other than these commercial farms. Small holder chicken producers found in the Region were not aware about the breed and its productivity. Therefore introduction and evaluation of this chicken breed under small holder level in the Region were mandatory. This trial was the basic step and contributes a lot for the current broiler production in the Region.

Objectives:

- To introduce broiler chicken breeds and evaluate their performance at small holder level.
- To study the perception of small holder producers and end users on production, processing and consumption of broilers.

MATERIALS AND METHODS

Study area and participants:

This trial was done at Bahir Dar city, Amhara Region. A total of 10 participants were selected in collaboration with Bahir Dar city urban agriculture office. Practical training was prepared and given to all participants on management of birds (feeding, health care, housing, etc.), chicken house construction and data collection. After the training, each participant constructed small-scale chicken house designed for 100 day old chicks and equipped with necessary husbandry equipments like; feeders, drinkers, brooder and brooder guard. The commercial feed was purchased from Alema Feed Company, Debre-Zeit, Ethiopia. Each participant received 400kg of feed (150kg starter and 250kg finisher). Based on the feed company information, the nutritive value of the feed is presented in table 1.

Table 1 - Nutritive value of the feed used for broiler adaptation trial

No.	Feed type	Nutritive Value								
		ME (KCal/kg)	CP (%)	Lys (%)	Meth (%)	M+C (%)	EE (%)	CF (%)	Ca (%)	P (%)
1	Starter Feed	3000	22	1.2	0.5	0.9	9	5	1	0.8
2	Finisher Feed	3100	19	1	0.4	0.8	10	5	0.9	0.7

Remark: ME=Metabolizable Energy, CP=Crude Protein, Lys=Lysine, Meth=Methionine, M+C=Methionine+Cystine, EE=Ether Extract, CF=Crude Fiber, Ca=Calcium, P=Phosphorus.

Figure 1. Pictures of some participants with their birds

Experimental Birds and Management:

A total of 1100 broiler day old chicks of Hubbard Classical breed were purchased from Debre Zeit Agricultural Research Center and transported to Bahir Dar city. Deep litter housing system was used and the litter was disinfected with formalin before receiving the day old chicks. Brooding was done using infra-red lamp for four weeks of age. Data collection formats were prepared and given to each participant so as to record all relevant data.

Disease prevention and control:

Routine vaccination against Newcastle and Gumborro diseases were given as recommended by the manufacturers. On top of this, strict bio-security measures were employed during the entire rearing period. Treatments for other diseases like Coccidiosis were given as it was occurred. Feed was supplied three times a day as recommended by the management guide of the breed.

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Data management and statistical analysis

The qualitative and quantitative data-sets were analyzed using appropriate statistical analysis software (SPSS, 2002). More specifically descriptive statistics and General Linear Model (GLM) were used for this study. The following linear model was used during analysis of quantitative data:

Model statement regarding the effect of age on mortality: $Y_{ij} = \mu + m_i + \varepsilon_{ij}$;

Where Y_{ij} is the chicken performance parameter estimate for bird j in age i, μ is the overall mean, m_i is the fixed effect of age in weeks (i=6; week1, week 2, week 3, week 4, week 5, week 6) and ε_{ij} is the residual error.

Data collected

The following data were collected from the trial: weight of day old chicks (g), weekly and cumulative mortality percentages, daily and weekly feed intake, cumulative feed intake, weekly and total body weight gain/bird (g), final weight of chicks (g), weekly and total feed conversion ratio (FCR), market price per chicks (live and processed), variable cost, total revenue (ETB), total gross margin (ETB), perception of participants and end users.

RESULT AND DISCUSSION

Growth performance

The average weight old day old chicks (DOC) at arrival was 45.5g (ranged 39.7g - 49.8g). The average final weight of chicks was 2094.3g (Table 2). The final weight obtained in this trial was lower than the genetic potential of the breed under ideal management system (2592g), (table 3). However; the result obtained in this trial was very promising, which fulfills the weight requirement of our end users (1kg-1.5kg carcass weight). The survey result showed that most hotels and super markets found in Bahir Dar city do not want a broiler meat weighing more than 1.5kg for preparation of Ariosto.

The average weight gain of birds at end of each week is presented in table 3. The minimum and maximum weights gain of birds at end of the trial was 1908.7g and 2176.5g, respectively. The highest weight gain was recorded at the end of the trial period, mainly at 5th week. The weight gain recorded in some participants at the final week was below the expected due to feed shortage.

Table 2 - Average weight of birds at end of each week (g)

Participant's code number	No of DOC received	Weight of DOCs	Av. weight end of 1st week	Av. weight end of 2nd week	Av. weight end of 3rd week	Av. weight end of 4th week	Av. weight end of 5th week	Av. weight end of 6th week
1	109	49.8	150.2	376.0	656.9	1303.5	1613.7	2068.6
2	108	47.5	134.0	400.0	728.5	1267.6	1595.0	1967.9
3	108	49.8	142.1	417.4	741.8	1262.7	1722.5	2226.3
4	110	47.8	136.2	362.1	708.8	1054.6	1480.7	2098.4
5	108	48.3	145.6	372.7	735.6	1245.5	1646.9	2063.3
6	114	48.4	137.8	363.1	681.8	1151.1	1505.5	1957.1
7	108	40.5	132.2	324.9	727.7	1118.5	1871.6	2201.0
8	108	40.7	130.0	344.2	701.7	1152.2	1731.6	2142.7
9	108	42.4	138.2	331.3	711.9	1084.3	1712.9	2002.9
10	108	39.7	136.2	369.7	737.7	1122.7	1793.1	2214.5
Mean	109	45.5	138.3	366.1	713.2	1176.3	1667.4	2094.3
±SD	±2	±4.1	±6.2	±28.6	±27.2	±86.6	±123.1	±100.2

Table 3 - Average weight gain of birds at end of each week (g)

Participant's code number	Av.wt. gain end of 1st week	Av.wt. gain end of 2nd week	Av.wt. gain end of 3rd week	Av.wt. gain end of 4th week	Av.wt. gain end of 5th week	Av.wt. gain end of 6th week	Total weight gain
1	100.4	225.8	280.9	646.6	310.2	454.9	2018.8
2	86.5	266.0	328.5	539.1	327.4	372.9	1920.4
3	92.3	275.3	324.4	521.0	459.8	503.8	2176.5
4	88.5	225.9	346.7	345.8	426.1	617.7	2050.7
5	97.3	227.1	362.9	509.9	401.4	416.4	2014.8
6	89.4	225.3	318.7	469.3	354.4	451.6	1908.7
7	91.7	192.7	402.8	390.8	753.1	329.4	2160.5
8	89.3	214.2	357.5	450.5	579.4	411.1	2102.0
9	95.8	193.1	380.6	372.4	628.6	290.0	1960.5
10	96.5	233.5	368.0	385.0	670.4	421.4	2174.8
Mean	92.8	227.9	347.1	463	491.1	426.9	2048.8
±SD	±4.5	±26.6	±35.1	±93.4	±156	±91.4	±102

Mortality of Birds

The result of the current study indicated that the average number of chicks died in the entire period was five. The minimum and maximum numbers of birds died were 2 and 7, respectively (table 4). The highest mortality rate

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(3.9%) was recorded at the first week. The average cumulative mortality percentage of birds was 4.8% (ranged1.9 - 6.5). According to the results, significantly ($p<0.05$) higher mortality percentage (4%) was recorded at the first week.

Mostly mortality level below 5% is expected in poultry farms and accepted as normal. This relatively low mortality is might be the result of timely application of vaccines /medications/ and better management of birds by participants. This low mortality percentage (<5%) was a very promising result and showed that broilers could be reared at smallholder level. The observed mortality rate (4.8%) was higher than the result obtained at Zimbabwe (2%) (Chimvuramahwe et al., 2011). It was also higher than the observed mortality result (0%) at Axum University Ethiopia (Gangwar et al., 2010) and 2.2% at Jimma, Ethiopia (A. Getinet et al, 2013).

Feed intake of Birds

The average daily feed intake of birds is presented in table 5. Accordingly; the average daily feed intake of birds during the entire period was 89.2g

The average cumulative weekly feed intake is presented in table 6. The total average cumulative feed intake of each bird was 3765.7g. The daily, weekly and cumulative feed intake of birds recorded in this trial was lower than the genetic potential of the breed. This might be due to several factors including; the feed quality, the climatic condition and general management of birds. It is well known that it is difficult to create an ideal management condition under small holder chicken production system.

Feed Conversion Ratio (FCR)

The average FCR was calculated by dividing the consumed feed by the weight gain at end of each week (Table 7). Accordingly; the cumulative FCR recorded in this trial was 1.84. This means that birds consumed 1.84 kg of commercial feed to produce 1kg of meat. It was higher than the genetic potential of the breed, which was 1.74. This relatively higher FCR (low efficiency) could be related to the feed quality, feed consumption, feed wastage and water consumption.

According to the results; significantly lower FCR (high feed conversion efficiency) was recorded at the second week. The lower efficiency (higher FCR) was recorded at the 6th week of production period and this indicated that it was not economical to extend the rearing period after 42 days.

T able 4 - Average number of birds died at each week and cumulative mortality percentage

Participant's code number	Number of birds died at1st week	Number of birds died at 2ndweek	Number of birds died at 3rd week	Number of birds died at 4th week	Number of birds died at 5th week	Number of birds died at 6th week	Total number of birds died & mortality %
1	4 (3.7%)	0	1	0	0	0	5 (4.6%)
2	5 (4.6%)	0	1	1	0	0	7 (6.5%)
3	5 (4.6%)	0	0	0	0	0	5 (4.6%)
4	6 (3.5%)	0	0	0	0	0	6 (5.5%)
5	6 (5.6%)	1	0	0	0	0	6 (5.6%)
6	4 (3.5%)	2	0	0	0	0	6 (5.3%)
7	2 (1.9%)	1	0	1	0	0	4 (3.7%)
8	5 (4.6%)	1	0	0	1	0	6 (5.6%)
9	2 (1.9%)	0	0	0	0	0	2 (1.9%)
10	4 (3.7%)	0	1	0	0	0	5 (4.6%)
Mean±SD	4.3^{b}±1.4 (3.9%)	0.5^{a} ±0.7 (0.5%)	0.3^{a}±0.5 (0.3%)	0.2^{a} ±0.4 (0.2%)	0.2^{a}±0.3 (0.1%)	0^{a} ±0 (0%)	5±1.4 (4.8%)

^{a,b} Least square means with different superscript within a column are significantly different ($P < 0.05$)

Table 5 - Average daily feed intake of birds (g)

Participant's code number	Daily feed intake at 1st week	Daily feed intake at 2nd week	Daily feed intake at 3rd week	Daily feed intake at 4th week	Daily feed intake at 5th week	Daily feed intake at 6th week	Daily feed intake at entire period
1	22.5	49.7	78.3	152.4	88.2	126.1	86.2
2	21.3	58.5	85.4	132.5	91.2	105.5	82.4
3	24.3	48.4	85.3	122.1	133.3	147.5	93.5
4	23.0	49.7	86.7	91.4	113.8	175.6	90.0
5	23.3	53.5	96.4	136.2	125.6	139.8	95.8
6	19.9	49.9	85.1	128.7	104.8	139.4	88.0
7	22.4	44.6	92.6	108.9	188.3	103.1	93.3
8	22.7	49.3	82.7	117.8	158.9	126.3	93.0
9	21.9	42.2	91.3	96.3	150.9	93.2	82.6
10	23.0	46.0	85.7	96.3	149.4	125.2	87.6
Mean ±SD	22.4 ±1.2	49.18 ±4.6	87 ±5.2	118.4 ±20	130.4 ±32	128.16 ±24.2	89.2 ±4.7

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Table 6 - Average weekly feed intake of birds (g)

Participant's code number	Cumm. feed intake at 1st week	Cumm. feed intake at 2nd week	Cumm. feed intake at 3rd week	Cumm. feed intake at 4th week	Cumm. feed Intake at 5th week	Cumm. feed Intake at 6th week	Cumulative feed intake at entire period
1	157.6	347.7	547.8	1066.8	617.4	882.5	3619.8
2	148.8	409.6	597.9	927.3	638.4	738.3	3460.3
3	169.8	338.6	596.8	854.4	933.4	1032.8	3925.8
4	161.0	347.9	606.7	639.8	796.7	1229.2	3781.4
5	163.4	374.7	675.0	953.5	879.1	978.5	4024.2
6	139.4	349.2	596.0	901.0	733.6	975.5	3694.7
7	156.8	312.2	648.5	762.1	1317.9	721.4	3918.9
8	159.0	344.9	579.2	824.4	1112.4	883.9	3903.7
9	153.2	295.5	639.4	674.0	1056.0	652.5	3470.7
10	161.2	322.2	599.8	673.8	1045.8	876.5	3679.3
Mean ±SD	157.02 ±8.4	346.7 ±31.9	611.94 ±36.5	833 ±139.8	933.6 ±224.1	902.5 ±169.4	3765.7 ±196.1

Table 7 - Average weekly FCR and cumulative FCR

Participant's code number	Average FCR at 1stweek	Average FCR at 2ndweek	Average FCR at 3rdweek	Average FCR at 4th week	Average FCR at 5th week	Average FCR at 6th week	Cumulative FCR
1	1.6	1.5	2.0	1.7	2.0	2.0	1.8
2	1.7	1.5	1.8	1.7	2.0	2.0	1.8
3	1.8	1.2	1.8	1.6	2.0	2.1	1.8
4	1.8	1.5	1.8	1.9	1.9	2.0	1.9
5	1.7	1.7	1.9	1.9	2.2	2.4	2.0
6	1.6	1.6	1.9	1.9	2.1	2.2	1.9
7	1.7	1.6	1.6	2.0	1.8	2.2	1.9
8	1.8	1.6	1.6	1.8	1.9	2.2	1.9
9	1.6	1.5	1.7	1.8	1.7	2.3	1.8
10	1.7	1.4	1.6	1.8	1.6	2.1	1.7
Mean+SD	2.0±0.1[b]	1.5±0.1[a]	1.8±0.1[b]	1.8±0.1[b]	2.0±0.2[b]	2.1±0.1[c]	1.8±0.1

[a,b] Least square means with different superscript within a column are significantly different (P < 0.05)

Economics of broiler production

Partial budget analysis: Finished broilers were sold as live weight (per head) and as processed form (per kg) after 42 days of growing period. Labor was provided by family members and the cost was not considered. The economic analysis result showed that the average selling price of finished broilers per head and per kg carcass were 60.7 and 70.9 Ethiopian Birr, respectively (table 8). Partial budget analysis result indicated that smallholder broiler production was profitable with a net benefit of 10.75 ETB per head and 19.33 ETB per kg, respectively.

Participants that sold processed meat fetched 8.56 ETB per kg more than those participants who supplied live birds. In addition, the return could also increased by 4.30 ETB/head when the day old chicks and formulated feed supplied in the locality. The result of the current study indicated that the cost of feed for broiler production covered more than 70% of the total variable cost. Opara (1996) also agreed that feed accounts for 70-85% of the production cost of modern poultry production.

Table 8 - Partial budget analysis of small scale broiler production

Description	External input source		Local input source	
	Birr/head	Birr/kg	Birr/head	Birr/kg
Selling price of broilers	60.70	70.85	60.70	70.85
Variable costs	49.95	51.55	45.65	47.15
• Day old chick cost	6.00	6.00	6.00	6.00
• Feed cost	33.25	34.15	33.25	34.15
• Vaccine/Medication/ & Service cost	1.50	1.50	1.50	1.50
• Electricity	0.50	0.90	0.50	0.90
• Water	0.33	0.40	0.35	0.40
• Straw and hay	1.25	1.40	1.25	1.40
• Transport cost	4.30	4.37	-	-
Net benefit	10.75	19.35	15.05	23.70

Sensitivity analysis

The result of the current study indicated that profitability of broiler production will result in a positive net benefit for all production situations up to 10% output price reduction and 10% input price increment (table 9).

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Table 9 - Sensitivity analysis of small scale broiler production

Description	External input source		Local input source	
	Birr/head	Birr/kg	Birr/head	Birr/kg
Average selling price of broiler	60.70	70.85	60.70	70.85
Average variable cost	47.15	48.75	42.85	44.35
Net benefit	13.55	22.15	17.90	26.50
Sensitivity analysis				
+ 5% variable cost	49.50	51.20	44.95	46.60
- 5% selling Price of broiler	57.65	67.35	57.65	67.35
Net benefit	8.15	16.15	12.70	20.75
+ 10% variable cost	51.85	53.60	47.10	48.80
- 10% selling Price of broiler	54.65	63.80	54.65	63.80
Net benefit	2.80	10.15	7.55	14.95
+ 15% variable cost	54.20	56.05	49.25	51.05
- 15% selling Price of broiler	51.60	60.25	51.60	60.25
Net benefit	-2.60	4.20	2.35	9.20

Perception of producers and end users

Producers' opinion: The survey result indicated that all participants of the trial were highly satisfied by the breed. According to the producers the breed has paramount merit than any other chicken breeds they know before. Some of the merits mentioned by the participants were; very fast growth, high final weight, able to rear many cycles per year and rear as side activity (Table 10).

All participants mentioned that they have future plan to maintain broiler production since it was profitable. The survey revealed that presence of high demands for chicken meat (80%) and low supply poultry meat (40%) were good opportunity for broiler production in the area. The result revealed that participants were afraid to sustain the work in the future due to some production constraints. The major challenge raised by all participants was lack of day old chick supply in the region (Table 11).

Table 10 - Special merits of broilers as mentioned by growers

Special characteristics of broilers mentioned by producers	Number of respondents	Response (%)
Fast growth	10	100
High product (high final body weight)	10	50
Ability to do many cycles per year	10	50
Could be done as side activity	10	50

Table 11 - Challenges to sustain broiler production

List of Constraints	Number of respondents	Response (%)
Lack of broiler day old chicks in the Region	10	100
Lack of formulated feed supply	10	70
Lack of promotion	10	50
High feed cost	10	40
Lack of appropriate health services	10	30
Lack of knowledge (poor training access)	10	30
Lack of husbandry and processing equipments	10	20

Consumers' and retailers' opinion:

Consumer's preference was assessed by interviewing hotel managers, super market owners and chefs. The result revealed that majority of the hotels was familiar with broiler meat by importing from commercial farms concentrated around Addis Ababa.

Most Hotels' chefs mentioned that broilers have many good characters as compared to other breeds like; fast cocking, keeps its flavor, used for all type of cooking except local soup (watt) and presence of good portion. Hotels managers said that most consumers preferred broiler meat as it is very soft as compared to local chicken meat. Most Hotel managers mentioned that broiler meat was highly preferred by foreigners/tourists/. The survey indicated that chicken meat demand of Bahir Dar city increased during high tourist flow seasons of the year, October to April. Some hotels managers told us that they have less demand for higher broiler weight, mainly greater than 1.5kg. Most hotels required a carcass weighing from 1kg to 1.5kg. This was highly related with the cost of the raw meat and their selling price of cooked meat (Ariosto).

CONCLUSION AND RECOMMENDATION

- The result of the current study indicated that there is high and growing demand for broiler meat in Bahir Dar city and the nearby cities.
- The lower mortality rate (<5%), the higher average final weight (2092.1g) and a relatively fair FCR (1.84) achieved in this study revealed that broilers could be produced and managed by smallholder chicken producers.

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- Feed cost and transportation cost was the major expenditures (60-70%) recorded in this study. The bulk of the feed cost arises from protein concentrates such as groundnut cake, fish meal and soybean meal. This feed cost could be reduced by providing practical trainings to producers on best-cost ration formulation using locally available feed ingredients.
- The result revealed that growers who sold semi-processed broiler meat fetched better profit than those who sold live birds and this showed that processing could be done at small holder level. This could be achieved by providing practical training on meat processing.
- Lack of day old chicks and formulated feed were the major limitations raised by most growers and end users so as to sustain broiler production in the region. Construction of broiler parent stock (BPS) and feed processing plant in the Region could be a solution to sustain the production in the area.

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