

## Effect of feeding different levels of red and black varieties of finger millet (*Eleusine coracana*) as replacement for maize on carcass evaluation of broiler chickens

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### Abstract

An experiment was conducted to evaluate effect of replacing maize with two varieties of finger millet (FM) (*Eleusine coracana*) on **carcass evaluation** of broiler chickens. Total of six hundred (600), one day-old chicks of Arbor acre breed were used for this experiment and fed red and black FM. Birds were allotted into ten (10) treatments of threereplicates, 20 birds per replicate. Treatments 1 and 6 had no FM. Treatments 2, 3, 4 and 5 had red FM while treatments 7, 8, 9 and 10 had black FM. Figures connote number of treatment and replacement levels of FM which signifies 0, 25, 50, 75, 100% and 0, 25, 50, 75 and 100% for red and black FM, respectively using 2x5 factorial arrangement in Completely Randomized Design (CRD). Parameters evaluated included live weight, carcass weight, dressing percentage, prime cuts and organ weights. Significant ( $P < 0.05$ ) main effect was observed in dressing percentage, back, thigh, wings and lungs for replacement levels. However, there was significant ( $P < 0.05$ ) interaction in back and thigh while drumstick, breast and wings had none and all organ weights were not affected by FM varieties across dietary treatments. Highest (2276g) weight was in birds fed 75% red FM which was more than controls (2012g). Generally, birds fed FM performed better compared to birds fed maize based diets. Chickens fed FM compared favourably with birds fed maize-based diets. Therefore, red and black finger millet can be recommended for farmers especially red FM to be incorporated into broiler chicken feeds.

**Keywords:** Finger millet, broiler chickens, maize, varieties

## Effet de l'alimentation des différents niveaux de variétés rouges et noires de millet de doigt (*Eleusine coracana*) en remplacement du maïs sur l'évaluation de la carcasse des poulets à griller



### Résumé

Une expérience a été menée pour évaluer les effets du remplacement du maïs avec deux variétés de mil du doigt (MD) (*Eleusine Coracana*) sur l'évaluation de la carcasse des poulets à griller. Total de six cents (600), une race de race d'arbre d'arbres d'une journée a été utilisée pour cette expérience et une MD rouge et noir. Les oiseaux ont été attribués dans dix (10) traitements de trois répliquats, 20 oiseaux par répliquat. Les traitements 1 et 6 n'ont pas de traitements MD 2, 3, 4 et 5 avaient rouge MD alors que les traitements 7, 8, 9 et 10 avaient noir MD. Les figures connaissent le nombre de niveaux de traitement et de remplacement de MD qui signifie 0, 25, 50, 75, 100% et 0, 25, 50, 75 et 100% pour MD rouge et noir, respectivement à l'aide d'un arrangement factoriel 2x5 dans une conception

### *Effect of feeding different levels of red and black varieties of finger millet (Eleusine coracana)*

*complètement randomisée (CCR). Paramètres évalués inclus du poids en direct, du poids de la carcasse, du pourcentage de dressing, des coupes de prix et des poids d'organes. Un effet principal significatif ( $p < 0,05$ ) a été observé dans le pourcentage de dressage, le dos, la cuisson, les ailes et les poumons pour des niveaux de remplacement. Cependant, il y avait une interaction significative ( $p < 0,05$ ) dans la cuisson et la cuisse tandis que le pilon, la poitrine et les ailes n'avaient aucun et tous les poids d'organes n'étaient pas affectés par des variétés de MD à travers des traitements diététiques. Le poids le plus élevé (2276g) était dans les oiseaux nourris à 75% de MD rouge, qui était plus que des contrôles (2012g). Généralement, les oiseaux nourris à MD ont fonctionné mieux comparés aux régimes alimentaires à base de maïs des oiseaux. Les poulets nourris à la MD comparé favorablement avec des régimes à base de maïs des oiseaux. Par conséquent, le millet de doigt rouge et noir peut être recommandé pour les agriculteurs, en particulier la MD rouge à incorporer dans des aliments de poulet à griller.*

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**Mots-clés:** millet du doigt, poulets à griller, maïs, variétés

#### **Introduction**

Broiler chickens being part of poultry birds have greatly influenced the lives of human beings positively by providing them with sources of proteins/food, employment and income. Delgado *et al.* (1999) projected that per capita consumption of livestock products will increase by about 50% from 1993 to 2020, with most of the increases attributed to developing countries, as a result of population growth, urbanization and rising incomes. Poultry has contributed to improving human nutrition and food security by being a source of high-quality protein, economic, social and cultural significance in small societies (FAO, 2010). It is no longer news that the cost of feed ingredients has continued to soar high everyday so that the ordinary farmers are finding it difficult to remain in poultry business. Conolly (2012) reported that feed cost is expected to continue in the upward swing. Today many farmers have been sent out of business because of everyday increase in the cost of both chicks and feeds, so much so that the feed millers are finding it difficult to produce affordable feed. Bot *et al.* (2013) reported that the need to source, process, and utilize alternative feed stuff otherwise known as unconventional feed ingredients in the diets of poultry birds is more critical now than ever. Holness (2005) stated that broilers have high mortgage

values and the meat of broilers yield less cholesterol than red meat. The world trend is towards the consumption of more white than red meat because white meat yields less cholesterol than red meat (Bot *et al.*, 2020). Acute shortage and high cost of feed ingredients have been identified as major hindrances to the expansion of poultry industry in Nigeria and other developing African countries (Fasuyi, 2005). Today, people especially women are not left behind in rearing broiler chickens no matter the number, it is because they are not only kept during the festive periods, more so; people now consume them at various occasions other than festive periods (Bot *et al.*, 2020). Funds invested in poultry production are recovered faster than in any other livestock enterprise (Oundipe and Sanni, 2002). Maize is the most commonly used energy source and the most predominantly fed grain used in poultry feed (Kellems *et al.*, 2010). Maize is a major ingredient used in livestock feed but competition between man and livestock for maize has resulted in high cost of the cereal, which has consequently resulted in high cost of feed and livestock production (Udokainyang *et al.*, 2019). Therefore, there is need to urgently look for feed ingredients that will equally substitute as an alternative to maize with equal to or nearly equal energy source (Bot *et al.*, 2021). Finger millet is a small

grain which is found among the different types of millet. The grain belongs to the family Poaceae which originated from Ethiopia and the sub-family *Chloridodeae* (Pradeep and Sreerama, 2015; Sood *et al.*, 2016). The grain is a semi-arid region crop cultivated in dry areas with limited rainfall and can adapt to various agro-climatic conditions (Gull *et al.*, 2014). Fernandez *et al.* (2003) reported that it is rich in two of the amino acids (methionine and tryptophan), and contains a substantial amount of the other essential amino acids except lysine. It is against this back ground that this project was designed to determine the performance of red and black finger millet in the carcass evaluation of broiler chickens.

## **Materials and methods**

### ***Study area***

The study was conducted at the Poultry Section of Federal College of Animal Health and Production Technology (FCAH&PT), in Livestock Investigation Division (LID), National Veterinary Research Institute (NVRI), Vom, Nigeria. Vom is located in the Guinea Savannah zone of Nigeria, with geographical location on longitude 8° 45' E and latitude 9° 44' N on an altitude of 4200 feet (1280 m) above sea level, relative humidity ranges from 22 % in January to 78 % July/August. The daily average environmental temperature ranges between 17°C – 28.6°C with mean monthly sunshine hours range of 177– 288.30 (NVRI, 2018).

### ***Source of Finger millet***

The grain which is popularly called finger millet or *tamba* locally was purchased from local markets in Ganawuri in Riyom Local Government Area of Plateau and Manchok in Kaduna States of Nigeria.

### ***Source of experimental birds***

Broiler birds used for this experiment were of arbor acre breed purchased from Pierodex hatchery/company located in BarikinLadi, BarikinLadi Local Government Area, Plateau State, Nigeria.

### ***Experimental diets***

Experimental diets were formulated according to the recommendation of NRC(1994)the starter diets contained metabolizable energy of 2800-2900 Kcal/kg with crude protein of 23% and fed to birds from day old. The finisher diets contained metabolizable energy of 2900-3000 Kcal/kg with crude protein of 20% and were fed to the chickens at the finisher phase. The experimental diets contained replacement levels of red and black varieties of finger millet (*E. coracana*) as the test ingredients at 0, 25, 50, 75, 100% and 0, 25, 50, 75, 100% representing treatments 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 respectively both at the starter and finisher phases. Treatments 1 and 6 were maize based diets, while treatments 2,3,4 and 5 had red finger millet and treatments 7,8,9 and 10 contained black finger millet. The compositions of experimental diets are presented in Table 1 and 2.

### ***Management of experimental birds***

The birds were raised on a deep litter system where wood shaven was used as bedding materials for the birds. Vitalyte was given to the birds to serve as anti-stress after every vaccine or drug administration. 200 watts' bulbs served as source of both heat and light to the birds. Feed and water were provided to the birds' *ad libitum*, all necessary vaccines were given according to the vaccination schedule as published by (NVRI 2010), Vom.

### ***Experimental design***

Six-hundred (600) day old broiler chicks of arbor acre breed purchased from Pierodex® hatchery/company which was used for the study. The chicks were allotted into ten dietary treatments with each treatment having three replicates and each replicate containing twenty birds using a 2x5 factorial arrangement in a completely randomized design. Red and black varieties of finger millets (*E.coracana*) with 5 replacement levels were used.

Table 1: Composition of broiler chickens starter diets containing different levels of red and black Finger millet (*E. coracana*) varieties as replacement for maize (0-4 weeks)

RBFM levels Ingredient (%)	Red variety					Black variety				
	0	25	50	75	100	0	25	50	75	100
Maize	57.00	42.75	28.50	14.25	0.00	57.00	42.75	28.50	14.25	0.00
Finger millet	0.00	14.25	28.50	42.75	57.00	0.00	14.25	28.50	42.75	57.00
Groundnut cake	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Soya bean meal	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lime stone	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>									
<b>Calculated analysis</b>										
Crude Protein (%)	23.00	23.40	23.70	24.10	24.50	23.00	23.40	23.70	24.10	24.50
ME (kcal/kg)	2926	2893	2860	2827	2794	2926	2893	2860	2827	2794
Ether Extract (%)	3.96	3.96	3.87	3.83	3.79	3.96	3.96	3.87	3.83	3.79
Crude fibre (%)	3.61	4.19	4.77	5.35	5.93	3.61	4.19	4.77	5.35	5.93
Calcium (%)	1.24	1.27	1.31	1.34	1.37	1.24	1.27	1.31	1.34	1.37
Av. P (%)	0.81	0.80	0.79	0.78	0.77	0.81	0.80	0.79	0.78	0.77
Lysine (%)	1.33	1.32	1.32	1.31	1.30	1.33	1.32	1.32	1.31	1.30
Methionine (%)	0.53	0.57	0.64	0.65	0.69	0.53	0.57	0.64	0.65	0.69
Feed cost (? /kg)	116.97	131.22	145.47	159.72	173.97	116.97	131.93	146.89	161.85	176.82

\*Vitamin-mineral premix provides per kg of diet: vit. A, 13,340iu; vit. D3, 2680iu; vit. E, 10iu; vit. K, 2.68mg; calcium pantothenate, 10.68mg; vit. B12, 0.022mg; folic acid, 0.668mg; choline chloride, 400mg; chlorotetracycline, 26.68mg; manganese, 13mg; iron, 66.68mg; zinc, 53.34mg; copper, 3.2mg; iodine, 1.86mg; cobalt, 0.268mg; selenium, 0.108mg; ME- Metabolizable Energy, Av. P- Available Phosphorus Diets 1 and 6 – Maize based Diets 2, 3, 4 and 5 – Red variety, Diets 7, 8, 9 and 10 – Black variety.

Table 2: Composition of broiler starter chickens diets containing different levels of red and black Finger millet (*E. coracana*) varieties as replacement for maize (5-8 weeks)

RBFM levels	Red variety					Black variety				
	0	25	50	75	100	0	25	50	75	100
<b>Ingredient (%)</b>										
Maize	60.00	45.00	30.00	15.00	0.00	60.00	45.00	30.00	15.00	0.00
Finger millet	0.00	15.00	30.00	42.50	60.00	0.00	15.00	30.00	45.00	60.00
Groundnut cake	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Soya bean meal	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Lime stone	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.20	0.50
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.00	0.20	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>									
<b>Calculated analysis</b>										
Crude Protein (%)	20.00	20.40	20.80	21.20	21.50	20.00	20.40	20.80	21.20	21.50
ME (kcal/kg)	2950	2915	2880	2845	2811	2950	2915	2880	2845	2811
Ether Extract (%)	3.62	3.58	3.53	3.49	3.44	3.62	3.58	3.53	3.49	3.44
Crude fibre (%)	3.77	4.38	4.99	5.60	6.21	3.77	4.38	4.99	5.60	6.21
Calcium (%)	1.34	1.37	1.40	1.44	1.47	1.34	1.37	1.40	1.44	1.47
Av. P (%)	0.79	0.78	0.77	0.76	0.75	0.79	0.78	0.77	0.76	0.75
Lysine (%)	1.22	1.22	1.21	1.20	1.20	1.22	1.22	1.21	1.20	1.20
Methionine (%)	0.50	0.54	0.62	0.63	0.67	0.50	0.54	0.62	0.63	0.67
Feed cost (–/kg)	112.38	127.38	142.38	157.38	172.38	112.38	128.13	143.88	159.63	175.38

\*Vitamin-mineral premix provides per kg of diet: Vit. A, 13,340iu; Vit. D3, 2680iu; Vit. E, 10iu; Vit. K,

2.68mg; calcium pantothenate, 10.68mg; Vit. B12, 0.022mg; folic acid, 0.668mg; choline chloride, 400mg;

chlortetracycline, 26.68mg; manganese, 13mg; iron, 66.68mg; zinc, 53.34mg; copper, 3.2mg; iodine,

1.86mg; cobalt, 0.268mg; selenium, 0.108mg; ME- Metabolizable Energy, Av. P- Available

Phosphorus. Diets 1 and 6 – Maize based Diets 2, 3, 4 and 5 – Red variety, Diets 7, 8, 9 and 10 – Black

variety.

## **Results and discussion**

### ***Main effect of feeding diets containing different levels of red and black varieties of finger millet as replacement for maize on carcass evaluation of broiler chickens***

The result of the main effect of diets containing red and black finger millet on the carcass quality of broiler chickens is presented in Table 3. It can be observed that there is no significant ( $P>0.05$ ) main effect of finger millet variety on all the parameters measured. Live weight range of 2012-2143g recorded on the replacement levels was better than 1750-2220g reported by Yunusa *et al.* (2015) for broiler chickens. The dressing percentage in birds on diets containing finger millet at replacement levels of 25 % and 75 % was significantly ( $P<0.05$ ) lower than those birds on the control diets. However, those on 50 % and 100 % replacement levels are similar to the birds fed control diets. This relatively low dressing % observed could be due to the impact of the replacement levels of finger millet on the birds. The result of dressing % range of 62.46-68.95g obtained in this study was lower than the range of 68.43-73.99g recorded by Tok *et al.* (2018) when *gayamba* millet was fed to broiler chickens. The back at 50 % and thigh at 75 % were significantly ( $P<0.05$ ) higher in birds fed millet-based diets respectively compared to the other treatments. The weight of wings was significantly ( $P<0.05$ ) lower in birds in the control group compared to the other treatments. The weight of the lungs was significantly ( $P<0.05$ ) higher in birds on 50 % finger millet replacement compared to the other treatments. However, finger millet had no significant ( $P>0.05$ ) main effect on the remaining prime cuts and organs weights. This suggests that finger millet is a potential alternative feed source that can be used to replace maize in feeding broiler chickens.

### ***Interaction effect of feeding diets containing different levels of red and black varieties of finger millet as replacement for maize on carcass evaluation of broiler***

### ***chickens***

The result of interaction effect of red and black finger millet with their replacement levels on carcass parameters of broiler chickens is presented in Table 4. There was significant ( $P<0.05$ ) interaction effect of variety and replacement levels of finger millet on live weight, back and thigh of broiler chickens. Increase in live weight, carcass weight and dressing percentage of birds was fluctuating as the finger millet replacement level increased across the dietary treatments. The best performance (2276g) in terms of live weight was observed in broilers fed diets containing 75% red finger millet. The live weight range of 2010g-2276g disagreed with the result of Tok *et al.* (2018) who reported live weight range of 1880g-2160g after feeding varying levels of *gayamba* millet to broiler chickens. The carcass weight and the dressing % did not give values as expected from the live weight; reason may be that some of the birds had more feathers and heavier organs that added to their live weights. Similar observation was made by Adeniji (2004) that the number of feathers and viscera possessed by birds depend on their body surface area and weight respectively which can increase or decrease their dressed weights. There was no significant ( $P>0.05$ ) interaction effect of diets containing red and black finger millet varieties and replacement levels on drumstick, breast and wings and all the organs of the broiler chickens. This result is in conformity with what was obtained by Tok *et al.* (2018) where most of the carcass parameters were not significantly ( $P>0.05$ ) different after feeding broiler chickens with varying levels of *gayamba* millet. The result also supported the report of Bedford (2006) and Panda (2006). The interaction effect observed in all the parameters measured was an indication of the better ability of the birds to tolerate the health challenges that they might have had, since the birds were able to build up muscles.

**Table 3: Main effect of Finger millet varieties and levels of replacement on carcass characteristics of broiler chickens**

Parameter	Varietal Effect (%)		Replacement levels (%)							SEM
	Red	Black	SEM	0	25	50	75	100		
Live weight (g/)	2105	2072	28.00	2012	2070	2104	2143	2112	44.27	
Carcass weight (g)	1378	1338	30.60	1388	1293	1392	1339	1378	48.30	
Dressing %	65.51	64.59	1.06	68.95 <sup>a</sup>	62.53 <sup>b</sup>	66.12 <sup>ab</sup>	62.46 <sup>b</sup>	65.17 <sup>ab</sup>	1.68	
<b>Prime cuts expressed as % carcass weight</b>										
Drumsticks	14.90	14.59	0.25	14.33	14.61	15.07	14.97	14.73	0.39	
Back	18.46	18.00	0.27	18.31 <sup>b</sup>	17.35 <sup>c</sup>	19.90 <sup>a</sup>	18.38 <sup>b</sup>	17.22 <sup>c</sup>	0.43	
Thigh	18.31	17.83	0.67	15.88 <sup>c</sup>	18.68 <sup>b</sup>	17.49 <sup>a</sup>	20.21 <sup>a</sup>	18.09 <sup>b</sup>	0.66	
Breast	35.14	34.67	0.73	35.49	35.33	33.08	35.08	35.04	1.15	
Wings	12.76	12.71	0.16	12.23 <sup>b</sup>	12.80 <sup>a</sup>	13.05 <sup>a</sup>	13.04 <sup>a</sup>	12.56 <sup>a</sup>	0.14	
<b>Organ weights expressed as % live weight</b>										
Heart	0.52	0.54	0.02	0.56	0.55	0.52	0.53	0.48	0.03	
Liver	1.74	1.63	0.07	1.79	1.74	1.67	1.61	1.62	0.10	
Lungs	0.62	0.61	0.03	0.61 <sup>ab</sup>	0.61 <sup>ab</sup>	0.70 <sup>a</sup>	0.55 <sup>b</sup>	0.60 <sup>ab</sup>	0.04	
Gizzard	1.66	1.66	0.05	1.59	1.67	1.72	1.56	1.77	0.07	
Spleen	0.10	0.11	0.01	0.12	0.10	0.10	0.09	0.10	0.02	
Abdominal	1.15	1.18	0.11	1.60	1.19	1.26	0.98	0.80	0.17	

abc: Means on the same row with different superscripts differ significantly (p<0.05)

SEM: Standard error of means

Table 4: Interaction effect of finger millet varieties and replacement levels on carcass characteristics of broiler chickens

RBFM levels Parameters	Red variety (%)					Black variety (%)					SEM
	0	25	50	75	100	0	25	50	75	100	
Live weight (g)	2012 <sup>b</sup>	2041 <sup>b</sup>	2141 <sup>ab</sup>	2276 <sup>a</sup>	2051 <sup>b</sup>	2012 <sup>b</sup>	2098 <sup>ab</sup>	2065 <sup>b</sup>	2010 <sup>b</sup>	2174 <sup>ab</sup>	62.60
Carcass weight (g)	1388	1318	1429	1426	1330	1388	1268	1354	1253	1425	48.30
Dressing (%)	68.95	64.44	66.76	62.61	64.77	68.95	60.63	65.48	62.30	65.57	2.38
<b>Prime cuts expressed as % carcass weight</b>											
Drumstick	14.33	14.75	14.75	15.32	15.34	14.33	14.47	15.40	14.62	14.12	0.55
Back	18.31 <sup>b</sup>	17.25 <sup>b</sup>	19.52 <sup>a</sup>	19.15 <sup>a</sup>	18.06 <sup>b</sup>	18.31 <sup>b</sup>	17.45 <sup>b</sup>	20.28 <sup>a</sup>	17.61 <sup>b</sup>	16.37 <sup>c</sup>	0.40
Thigh	15.88 <sup>b</sup>	18.44 <sup>b</sup>	17.09 <sup>b</sup>	21.56 <sup>a</sup>	18.58 <sup>b</sup>	15.88 <sup>b</sup>	18.91 <sup>b</sup>	17.88 <sup>b</sup>	18.87 <sup>b</sup>	17.61 <sup>b</sup>	1.22
Breast	35.49	35.29	34.57	36.24	34.12	35.49	35.36	31.60	34.93	35.96	1.62
Wings	12.23	13.84	12.55	13.34	12.83	12.23	12.75	13.54	12.74	12.28	0.35
<b>Organ weights expressed as % live weight</b>											
Heart	0.56	0.56	0.48	0.53	0.47	0.56	0.54	0.55	0.53	0.49	0.04
Liver	1.79	1.86	1.81	1.57	1.69	1.79	1.63	1.53	1.66	1.55	0.15
Lungs	0.61	0.62	0.76	0.48	0.62	0.61	0.60	0.63	0.61	0.59	0.06
Gizzard	1.59	1.68	1.67	1.61	1.77	1.59	1.67	1.78	1.51	1.77	0.10
Spleen	0.12	0.11	0.08	0.06	0.11	0.12	0.10	0.11	0.12	0.09	0.02
Abdominal fat	1.60	1.12	1.49	0.94	0.60	1.60	1.27	1.03	1.01	1.01	0.25

abc: Means on the same row with different superscripts differ significantly (p<0.05)

SEM: Standard error of means

## **Conclusion**

Based on the result of this experiment, it can be concluded that finger millet is energy rich which can improve the carcass quality of broiler chickens. Birds fed finger millet-based diets performed better than birds fed maize-based diets. Therefore, finger millet can comfortably be used in compounding feed for broiler chickens without any deleterious effects.

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