



Corn flour enriched with fish pasta products produced from defatted different heat treatment cooked pangasius meat

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Abstract

Pangasius fish contains more unfit fats. it will cause heart and brine diseases. it contains more essential amino acid and more good fat and nutritional content. it mostly contains high amount of saturated and mono-unsaturated fats and less amount of poly-unsaturated fats. This affects marketability value and due to its bad odour most of people are disliking it. Fats in it are removed or reduced by use the different heat treatment such as microwave oven method, grilled and steam method. These methods are used to render fats and converted to pasta products. This pasta product does not contain essential aminoacid due to heat treatment. Based on differentiation from three heat treatment methods, the study of nutritional differentiation and sensory evaluation on pasta product is done.

Keywords: corn flour enriched, pasta products, heat treatment

Introduction

Pangasius sp. are commonly found in the south-east Asian region. It belongs to pangasiidae family. The most common variety of cultured fish is *Pangasianodon hypophthalmus*. This fish species is also called as Sutchi catfish, striped catfish, or Tra fish. Among all the freshwater species, Pangasius catfish is the world's fastest-growing species in aquaculture. Pangasius sp. are popularly traded as skinless and boneless fillets worldwide along with portions, steaks, fillets, and also as value-added products. Pangasius sp. attains weight of 1.2 to 1.3 kg rapidly within six months and Harvested after eight months. There is a tremendous demand for fish-based products, especially value-added products such as ready-to-eat "convenience" products.

In general, the purpose of cooking was to improve the taste, flavor and reduction (or) inactivation of pathogenic microorganism. Since fish compositions are more sensitive to heat, light and oxygen, These combined cause leads to loss of nutrition during cooking.

During cooking of fish fillets, there is a change in proximate, minerals, vitamins and fatty acid composition (Garcia- Arisa *et al.*, 2003). Cooking was a very important factors which determines the final content of nutrition in fish (Badian *et al.*, 2013) [18]. Pangasius had high amount of SFA and MUFA which affect the quality of product and also affect the consumer accessibility. Different heat treatment such as microwave heat, grill oven and steaming were followed to remove the above fatty acids, Thereby to improve the nutritional quality and this process is called as Defatting. EPA and DHA are the remaining stable fatty acids during certain type of cooking (Larsen *et al.*, 2011) [7]. Vitamins like thiamine is more heat stable during heat treatment (Erkan *et al.*, 2010; Ersoy & Ozeren 2009) [16] and fat-soluble vitamins are less heat-labile than water soluble vitamins especially B group of vitamins.

The fishes were cooked in pressurized method. In general, it contains high content of the protein than without cooking meat. There is a no difference in total fat and omega-3 fatty acids content between raw and procesed freshwater *P.*

pangasius and marine fish, *H. macrura*. The marine fish are better in source of protein, fat and omega-3 content, while processed fish shows comparable amount of protein, fat and omega-3 fatty acids content with raw fish. The consumers to prepare a healthy menu in order to retain the protein and omega-3 fatty acids content of fish, The fish meat was cooked by different ways before consumption. There are different Cooking methods used which (boiling, baking, roasting, frying, and grilling) can be both beneficial and detrimental to nutrient content of the foods. On the time of cooking of meat, reaction takes place in changing the biochemical and physical content of portion of fillet, it will either improve or impact the food nutritional quality. The cooking was done to improve the hygienic quality of the food by inactivation or destroyed of pathogenic microorganisms and their promoted digestibility and bio-availability of nutrient in the digestive tract. It also improves the sensory quality of food by forming aroma compounds, attractive color, crust, and texture. The heat treatment will affect both chemical and biological function of some protein. On the time of direct heat treatment on portion of fillet, moisture will get evaporated to which affect the chemical composition of portion of fillets. There is no modification of amino acid profile due to cooking methods. The composition of fish fillets are affected by (feeding, sex, biological stage, season). It will affect the total fat, protein, and ashes contents and fatty acids composition of fish. The content of thermo-sensitive compounds, fat-soluble vitamins, or PUFAs are often reduced and the nutritive value of fish can be affected by cooking methods.

The concentration of ω 3 fatty acids in rainbow trout, vend ace, and pike flesh increased due to the cooking process (boiling, baking, microwave oven, and frying with sunflower and rapeseed oils). Drying in a hot air oven at 180°C for 90 min and microwave drying at 400 W for 8 min of grass carp resulted in a significant increase of protein content but reduced fat content. Changes in proximate chemical composition were more prominent in fried silver catfish. Heat treatment (boiling at 85-90°C during 10-15 min

and roasting under 250-280°C during 1520 min) will not decrease content of EPA and DHA in humpback salmon. García-Arias *et al.* have also reported that frying shows the highest water loss, fat gain, and affect the fatty acid composition of sardine. Which methods are suitable from a nutritional point of view, it is essential to recommend, the best cooking method preserving nutritional and healthy attributes of fish muscles. These recommendations should be based on the Examine and used in different cooking or heat treatment, it will affect an essential nutrition composition and it will give indicators of the quality attributes of fish muscle. Such as Protein, fat, and ashes are the essential nutritional fish muscle compounds which determine the energetic and nutritional values of the muscle. The content of unsaturated fatty acids could be retained as a healthy indicator of fresh and processed fish muscles. The chemical attributes of fresh fish species and the effects of different cooking methods on their chemical compositions is essential to enhance the good food behavior of consumers. The appropriate cooking methods should be done in preserving nutritional and healthy attributes of fish muscles. The present study aims to determine the influence of 3 cooking methods (steaming, grill oven-cooking, and microwave cooking) on the proximate chemical composition, fatty acid profile, ash contents, and metal contents of red mullet fillets.

Materials and methods

Materials

Pangasius hypophthalmus were collected from Madurai AM fish farm and fish markets. The collected fishes were kept in insulated iceboxes. Insulated icebox prevents dehydration, and temperature fluctuation thus delays the spoilage of fish. Further, it is easy to handle. Flake ice produced by flake ice machine was used during fish transportation and processing purpose. Size of the ice for 2-3 cm level were produced to kept into the box and fish were spread on ice layer and then carried out further steps.

Method

Preparation of dressed meat

The raw *Pangasius* sp. was collected from the market and washed with water. If any foreign material adhered to the outer surface, it was removed. Weight of the cleaned fish sp. was noted down. Removal of fins, head, Evisceration was carried out and further washed in clean water. The weight of dressed meat was noted down.

Cooking of pangasius fillets and pasta preparation

- -Raw meat (*Pangasius* sp)
- -Dressed meat
- -Washed with water
- -Steam cooking (98°C for 15 minutes)
- -Microwave oven cooking (110°C for 6 minutes)
- Grilled oven cooking (120°C for 15 minutes)
- -Reduced content of SFA and MUFA

Sampling procedure

Randomly, samples were chosen and studied at different time and temperature was used to remove fat from the fillets. The time and temperature which gave better removal of fat is suitable for standardization of time and temperature. Samples were collected from raw fillets, microwave cooked meat, grilled meat, Steam cooked meat and analysis of fatty

acid composition. The focus of study is mainly on saturated and mono-unsaturated fatty acid from defatted fish meats.

Microwave oven cooking

The domestic microwave oven was used for cooking of *Pangasius* fillets. Fillets were kept in the oven to reach the core temperature of 110°C for 6 minutes.

Grilled oven cooking

Grilled oven cooking was carried out in a prestige grilled oven. In this cooking method, the fillets were kept in the oven to reach the core temperature of 120°C for 15 minutes.

Steam cooking

The steam cooker was used for this cooking method. The meat was kept in the cooker to reach the core temperature of 98 ± 2°C for 15 minutes.

Fatty acid composition analysed by Gas chromatography

Fatty acids are very important components of lipid content. GC is most common method in analysing fatty acid composition. The fatty acid is a complex structure and it contains many components of fatty acid such as acylglycerols, cholesterol esters, waxes and glycosphingolipids. It is extracted by process of saponification hydrolysis. It is done by alkaline medium AOAC, 1990. The FAMES are extracted by use of the methanol and boron trifluoride. Extraction and methylation are done by folch method are used to obtained the lipid components from the ten gram of fish samples. Esterification was done, take 250g lipid fraction it is dissolved in toluene in the round bottom flask. Then, 4ml sodium hydroxide is added and refluxed for 5-10 minutes until droplets of fat disappears. 5ml of methanol is added and then refluxed for another 1min. the content is cooled and then 15ml of saturated sodium chloride solution is added. Then, 5ml of hexane is added and shaken well and then remove the upper layer hexane layer. Repeat the extraction with hexane twice. it is combined with the hexane layer and evaporated to dryness in a rotary flask evaporator set at 55-60°C. The methyl esters in 1ml of HPLC grade hexane for injection in GC.

The column at 210°C for 30 minutes. Ten, inject 0.5ml of standard FAMES mixture onto the GC. Then, it is started and the separation of FAMES takes 45min. Next, inject 0.5ml of sample FAMES. Identify the individual fatty acid in the sample by comparing the retention time of the individual fatty acid in the standard mixture. Calculate area unit value expressed to percentage of the fatty acid of total lipids is done.

Proximate composition analysis

The protein, fat, ash, water and carbohydrate content were analyzed by AOAC methods (2000). 1 gram of wet sample needed for analysis of protein content, 4.5-5 gram of samples are used to estimate of the fat content, 2 gram of dry sample are used to estimate of the ash and 10 gram of wet samples are used to analysis the moisture content. The protein content of raw fillet, cooked meat and pasta product was analyzed by the Kjeldahl method (1883). The digester temperature was followed at 300 to 400°C and distillation

process was run for 8 minutes. The fat content of raw fillet, cooked meat and pasta product was analysed by Folch methods (1957). The moisture content of raw meat, cooked meat and pasta products were analysed by AOAC methods (2000). The samples were kept in hot air oven for 12 hours at 100 °C. Ash content of raw meat, cooked meat and pasta products were analysed by AOAC methods (2000). The samples were kept in muffle furnace for 24 hours at 550 °C. The carbohydrate content of raw meat, cooked meat and pasta products were analysed by different methods. The chemicals used for estimating the protein includes sulfuric acid, digestion mixture: copper sulfate-0.1g and potassium sulfate-2.5 g for each sample, sodium hydroxide, 40%, boric acid, 4%, mixed indicator: methyl red-0.16g and bromocresol green-80 mg in 100ml of 95% ethanol and standard sulfuric acid 0.1N.

Fat composition was analyzed by chemicals includes chloroform and methanol (2:1) and potassium chloride (KCL), 0.74%. and another method of soxhlet used in 80 ml of petroleum ether is used to estimate the fat composition. Crude fiber is estimated by chemicals includes sulfuric acid 1.25% and sodium hydroxide 1.25% and petroleum ether 40-60 °C.

Sensory evaluation

Sensory evaluation of pasta product was carried out by trained and untrained panelists using 9 points hedonic scale according to (Yousef *et al.*, 2003; prabhasankar *et al.*, 2009a) [40].

Statistical analysis

The SPSS 19 (IBM, 2010) statistical package was used for analysis of experimental results. The results were produced in the mean standard deviation.

Result and Discussion

Different heat treatment methods remove the fats from Pangasius meat convert to corn enriched pasta

There are different heat treatment to remove fats from fish fillets. In microwave heating process, the heating is done by exposing the fish fillets to radiation of electromagnetic wave come from electromagnetic spectrum with range of wave length 0.3-300GHz (Ahmed & Ramaswamy, 2007) [23]. This type of instrument is recently used for widely application of food products in both domestic as well as industrial process (Baffler 1993; Cerretani *et al.*, 2009) [19]. During heating of food in microwave oven by interaction of electromagnetic field with chemical constituents of foods, this interaction raise it is comprising molecular fraction and excitation generated if need for cooking purpose (Inchingolo *et al.*, 2013; Mishra *et al.*, 2012; Domiszewski *et al.*, 2011) [21, 22, 20]. In general, fish muscle protein was highly sensitive to microwave oven and texture of meat become it very dry, hard and rubbery appearance due to heated with elevated temperature (Mizrahi 2012). Microwave cooking of meat in higher temperature results in loss of nutrition from fish fillets (Shimi 1992) [24]. Cook-chilled products will vary in wide range of 6 – 42 days depending upon the heat treatment (Ahmed & Ramaswamy 2007) [23].

The raw fish fillets contain high fat content, but after heat treatments fat content reduced due to production of primary and secondary oxidative products. (Regulska-Iiow & Iiow

2002). Mineral composition was very important for health life. Steaming method provides desirable for sensory property and loss of minimum content of nutrients and also plays a important role in destruction of microorganism. At the time of cooking of fish meat containing water, the physical and chemical properties will get changed. Digestibility of fish will get increased due to denaturation of proteins and PUFAs content get reduced in during heat treatment (Raj *et al.*, 2008; Asmah *et al.*, 2014) [26, 33]. (Nurhan, 2007) [27] Observed that the cooking process affects the amino acid content. The various fish fatty acid profile can be affected by various cooking methods it was reported given by (Nurhan 2007; Weber *et al.*, 2008; Larsen *et al.*, 2010; Koubaa *et al.*, 2012; Sengor *et al.*, 2013; Asmah *et al.*, 2014; Neff *et al.*, 2014) [27, 36, 29, 30, 31, 32]. This type of heat treatment reduced the lipid content and retain vitamins C, and preserve the colour and texture of various food products (Idrus & Yang, 2012). The cooking will reduce amount of amino acids and PUFAs in the fish meat and also used in determination the super-heated steam cooking are influence into fish nutritional composition which has include in proximate composition, fatty acid and amino acid composition.

In Grill, heat was produced and discharged through a tube which was used to cook the food. Grill microwave oven is suitable for reheating, cooking and grilling the various food items. The oven was maintained with preheat oven temperature up to 275F. Based on cooking process. Proximate composition of grilled fish products was studied by (Bochi *et al.*, 2008) [28, 36].

In case of low fat fish, moisture and fat contents are not affected by grilling methods and it does not affect the chemical composition of final products (Dreeling *et al.*, 2000) [37]. The minerals content can be affected during cooking. (Kucukgulmez *et al.*, 2006) [38].

The present research proposed to Defatted from Pangasius meat and convert to value added products of corn enriched with fish pasta and to study the proximate composition based on cooking methods and sensory evaluation differentiation based on cooking methods and different concentration of fish flour inclusion. Proximate composition varies with different heat treatment methods. After heat treatment, the moisture content will get decreased from raw meat to cooked meat the microwave cooked meat is given best reduction of moisture content from Pangasius meat. Protein, fat and ash content will getincreased after heat treatment. High amount of protein present in the steam cooked meat and high content of fat has been reudced in the steam cooked meat and ash content was increased by grilled cooked methods.

Fatty acid composition of raw meat contains more saturated and mono-unsaturated and less poly-unsaturated fatty acids. After heat treatment SFA and MUFA has been decreased but PUFA has been increased. Microwave cooking method shows best reduction of SFA and MUFA and PUFA was increased by steam cooking method. After heat treatment by grilled methods shows increased mineral composition which is the best methods to promoted to development of pasta products.

Proximate composition of pasta products and sensory evaluation

Pasta added with fish flour reduces the moisture content and carbohydrate and increases the lipid, protein and ash content of fish pasta. Addition of tilapia flour to fish results in the lower amount of carbohydrate and higher amount of protein, fat and lipid content (Monterio MLG, *et al*, 2014). This results stated that the content of ash, fat, protein content was increased and moisture and carbohydrate decreased due to addition of fish flour with pasta products compared with control pasta (Hong SR, Yoo B, 2012, USDA-2016). There are different concentration of fish flour which is added with pasta products. There are four concentrate with which is best nutritional content was prepared suitable for consumer performance. The sensory assessment of pasta products samples was carried out by trained and untrained panels and the hedonic scale were used. It has 1–9 rating scale starting from dislike extremely to like extremely (Yousef *et al*. 2003; Prabhaskar *et al*. 2009a) ^[40]. Further, four sensory characteristics were included, color, aroma, flavor and aftertaste and have maximum score point of 10. Total or overall acceptability of sensory attributes at $10^X = 4 = 40$. It could be accepted for both intensity, hedonic and overall acceptability (Lee *et al*.1991). Microwave cooked fish with corn pasta with which Sample-I has an amount of moisture-5.85%, protein-11.76%, fat-1.34% and carbohydrate-80.10% and ash-0.94%. Sample-II has moisture-5.41%, protein-14.36%, fat-1.56%, ash-1.07% and carbohydrate-77.58%. Sample-III has moisture-4.87%, protein-17.66%, fat-1.84%, ash-1.35% and carbohydrate-74.26%. Sample-IV has moisture-4.45%, protein-21.07%, fat-2.15%, ash-1.67% and carbohydrate-70.64%. Sample-V has moisture-4.17%,

protein-24.86%, fat-2.55%, ash-1.94% and 66.47%. Sensory evaluation has been studied about the fish which is added with corn pasta. There are five different samples and average score Sample-I 8.68%, Sample-II 8.83%, Sample-III 8.86%, Sample-IV 8.91% and Sample-V 8.95%. Grilled cooked fish with corn pasta with which Sample-I has an amount of moisture-5.85%, protein-11.76%, fat-1.34%, ash-0.94% and carbohydrate-80.10%. Sample-II has moisture-5.45%, protein-13.87%, fat-1.15%, ash-1.05% and carbohydrate-78.46%. Sample-III has moisture-4.93%, protein-16.83%, fat-1.44%, ash-1.26% and carbohydrate-75.52%. Sample-IV has moisture-4.33%, protein-20.63%, fat-1.75%, ash-1.45% and carbohydrate-71.83%. Sample-V has moisture-4.05%, protein-23.97%, fat-2.05%, ash-1.75% and 68.17%. Sensory evaluation has been studied about the fish added with rcorn pasta. There are five samples and the added score average are Sample-I 8.89%, Sample-II 8.93%, Sample-III 8.93%, Sample-IV 8.95% and Sample-V 8.97%. Steam cooked fish with corn pasta with which Sample-I has an amount of moisture-5.85%, protein-11.76%, fat-1.34%, ash-0.96% and carbohydrate-80.10%. Sample-II has moisture-5.18%, protein-14.87%, fat-1.63%, ash-1.32% and carbohydrate-76.98%. Sample-III has moisture-4.83%, protein-17.96%, fat-1.86%, ash-1.56% and carbohydrate-73.80%. Sample-IV has moisture-4.46%, protein-20.95%, fat-2.07%, ash-1.73% and carbohydeate-70.77%. Sample-V has moisture-4.03%, protein-23.98%, fat-2.24%, ash-1.97% and carbohydrate-67.76%. Sensory evaluation has been studied about the fish added with corn pasta. There are five samples and the added score averages are Sample-I 8.55%, Sample-II 8.75%, Sample-III 8.85%, Sample-IV 8.85% and Sample-V 8.96%.

Table 1: Proximate composition of different cooked fish meat with corn pasta products

Composition	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Moisture	5.85±0.000%	5.41 ± 0.001%	4.87±0.000%	4.45±0.000%	4.17 ± 0.000%
Protein	11.76±0.000%	14.36 ± 0.000%	17.66±0.000%	21.07±0.000%	24.86 ± 0.000%
Fat	1.34±0.000%	1.56 ± 0.000%	1.84±0.000%	2.15±0.000%	2.55 ± 0.000%
Ash	0.94±0.000%	1.07 ± 0.000%	1.35±0.000%	1.67 ± 0.000%	1.94 ± 0.000%
Carbohydrate	80.10±0.000%	77.58±0.000%	74.26±0.000%	70.64±0.000%	66.47±0.000%

Table 2

Composition	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Moisture	5.85±0.000%	5.45±0.001%	4.93±0.000%	4.33±0.000%	4.05±0.000%
Protein	11.76±0.000%	13.87±0.000%	16.83±0.000%	20.63±0.000%	23.97±0.000%
Fat	1.34±0.000%	1.15±0.000%	1.44±0.000%	1.75±0.000%	2.05±0.000%
Ash	0.94±0.000%	1.05±0.000%	1.26±0.000%	1.45 ± 0.000%	1.75±0.000%
Carbohydrate	80.10±0.000%	78.46±0.000%	75.52±0.000%	71.83±0.000%	68.17±0.000%

Table 3

Composition	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Moisture	5.85±0.000%	5.18±0.001%	4.83±0.000%	4.46±0.000%	4.03±0.000%
Protein	11.76±0.000%	14.87±0.000%	17.96±0.000%	20.95±0.000%	23.98±0.000%
Fat	1.34±0.000%	1.63±0.000%	1.86±0.000%	2.07±0.000%	2.24±0.000%
Ash	0.94±0.000%	1.32±0.000%	1.56±0.000%	1.73±0.000%	1.97±0.000%
Carbohydrate	80.10±0.000%	76.98±0.000%	73.80±0.000%	70.77±0.000%	67.76±0.000%

Table 4

Test	t-test-I	f-test-I	t-test-II	f-test-II	t-test-III	f-test-III	t-test-IV	f-test-IV	t-test-V	f-test-V
Moisture	0.000	0.3	0.000	0.0	0.000	0.2	0.000	0.1	0.000	0.0
Protein	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0
Fat	0.000	0.0	0.000	0.2	0.000	0.2	0.000	0.2	0.000	0.0
Ash	0.000	0.2	0.000	0.2	0.000	0.0	0.000	0.0	0.000	0.0
Carbohydrate	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0

Table 5: Sensory evaluation parameters of microwave cooked fish meat addition with corn pasta

Evaluation parameters	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Appearance	8.67%	8.88%	8.76%	8.98%	8.95%
Texture	8.79%	8.82%	8.89%	8.89%	8.98%
Color	8.58%	8.75%	8.95%	8.82%	8.93%
Flavour	8.72%	8.87%	8.89%	8.89%	8.96%
Taste	8.64%	8.86%	8.83%	8.97%	8.97%
Total	8.68±0.00%	8.83±0.00%	8.86±0.00%	8.91±0.00%	8.95±0.00%

Table 6

Evaluation parameters	T-test	F-test
Sample-I-II	0.006	0.453
Sample-II-III	0.504	0.572
Sample-III-IV	0.322	0.869
Sample-IV-V	0.156	0.034

Sensory evaluation parameters of grilled cooked fish meat addition with corn pasta

Table 7

Evaluation parameters	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Appearance	8.85%	8.87%	8.90%	8.94%	8.98%
Texture	8.84%	8.89%	8.94%	8.97%	8.97%
Color	8.98%	8.97%	8.96%	8.94%	8.96%
Flavour	8.89%	8.94%	8.95%	8.95%	8.98%
Taste	8.90%	8.98%	8.91%	8.99%	8.99%
Total	8.89±0.00%	8.93±0.00%	8.93±0.00%	8.95±0.00%	8.97 ± 0.00%

Table 8

Evaluation parameters	T-test	F-test
Sample-I-II	0.281	0.801
Sample-II-III	0.937	0.251
Sample-III-IV	0.123	0.739
Sample-IV-V	0.138	0.240

Sensory evaluation parameters of grilled cooked fish meat addition with corn pasta

Table 9

Evaluation parameter	Sample-I	Sample-II	Sample-III	Sample-IV	Sample-V
Appearance	8.58%	8.73%	8.81%	8.89%	8.96%
Texture	8.53%	8.74%	8.88%	8.87%	8.95%
Color	8.55 %	8.79%	8.87%	8.88%	8.94%
Flavour	8.58%	8.75%	8.84%	8.84%	8.97%
Taste	8.52%	8.78%	8.89%	8.82%	8.99%
Total	8.55±0.00%	8.75±0.00%	8.85±0.00%	8.85±0.00%	8.96±0.00%

Table 10

Evaluation parameters	T-test	F-test
Sample-I-II	1.000	0.896
Sample-II-III	0.000	0.661
Sample-III-IV	0.921	0.828
Sample-IV-V	0.000	0.440

Conclusion

There are three heat treatment methods such as microwave

cooked, grilled, steam cooked fish with wheat pasta. Main purpose of these study is to differentiate among pasta

products and it is based on proximate and sensory score value. Overall there is a good score for steam cooked meat with corn pasta due to no loss in nutrition during cooking the meat. Grilled meat contains more nutrient compared with microwave cooked meat. The grilled cooked meat with pasta has been selected as the best among three pasta products.

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