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NUTRIENTS COMPOSITION IN SELECTED KEY FOODS OF ANIMAL ORIGIN OF BANGLADESH

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ABSTRACT

Food composition analysis provides detailed information about nutrientsand other important food components, which are important tohuman nutrition. Nutritional status of a person depends on the consumption of foods and intake of various nutrients related to the composition of foods. The aim of the study was to determine nutrients composition of selected animal source foods consumed in Bangladesh. **Method and Materials:** Composite samples are used for analysis. To analyze the proximate composition, B-vitamins and retinol of the commonly consumed animal source foods of Bangladesh prioritized by "Key Foods" approach The samples were three cultured fish (Pangas, Rohu and Tilapia), farmed chicken (breast and leg portion), farmed chicken egg and milk (cow, pasteurized). There are 30 AEZ (agro-ecological zones) in Bangladesh, categorized mainly on crop production. Samples were collected from 2-3 sites of each division that automatically cover all major AEZ. Selected animal source food samples were collected from 14 Haats across all seven divisions (considering 70% of rural population) and wholesale/retail markets of city corporation areas (considering 30% of urban population). Food samples collected following the stratified sampling frame. **Result:** Proximate composition of analyzed cultured fishes shows that moisture, protein and fat content of Rohu and Tilapia are quite similar, whereas Pangas contain higher fat and lower protein content. As pangas contain much higher fat, energy values is higher than other two fishes. Ash content of three fish is almost same. Proximate composition of two portions of chicken does not vary significantly, except for fat. As chicken leg contain much higher fat, energy values is higher than chicken breast. Among the proximate nutrients egg contain higher amount of protein and fat than milk. B-vitamins analysis of three cultured fish shows that thiamin content of three fishes is Tilapia, Rohu and Pangas. Riboflavin content is high in Rohu and low in Pangas. Vitamin B_6content of three fish is almost same. In terms of these three B-vitamins, Rohu and Tilapia are better than Pangas. Among the B-vitamin content of chicken, thiamin content of chicken breast is higher than leg and riboflavin content is higher in chicken leg than breast. Vitamin B_6 content of two portions is almost same. B-vitamin content of analyzed milk and egg shows that thiamin content of milk is almost one third of egg. Milk contains highest amount of riboflavin among the analyzed samples. Egg contains almost three times higher vitamin B_6 as compare to milk. Among the three fish, retinol content is relatively higher in Pangas and low in Tilapia. Chicken breast contains higher retinol than chicken leg. Egg has highest amount of retinol among analyzed samples. **Conclusion:** The food composition data of selected key foods provided in the study can be used for formulating the nutritive diets and calculating the value of diets, quantitatively assessing for individuals or different population groups for diet therapy and nutritive diets management in Bangladesh. Bangladesh could over comenutritional challenges as an under developed country through this types of very essential food values and nutrient composition studies today & in near future.

KEYWORDS: Samples were collected from 2-3 sites of each division that automatically cover all major AEZ.

INTRODUCTION

Authentic data on the nutrient composition of foods for human consumption are in critical for many areas of health assessment, formulation of institutional and therapeutic diets, nutrition epidemiological research on diet and diseases. Consumer protection, nutrition labeling, food policy & regulation, plant breeding as well as various applications in agriculture research,

development and assistance are facing limitation due to sourcing accurate data. Today, this information particularly in relation to energy-yielding substrates and essential nutrients has been obtained from food composition tables. It is apparent that the currently available foods composition tables in Bangladesh needs updating with recent data, particularly for vegetables, fruits and fishes. Accordingly the existing foods related data of the mainstream foods regime of Bangladesh could be improved by adding recent nutrients values of foods composition. Knowledge of the chemical composition of foods is first essential in the dietary treatment of disease or in any quantitative study of human nutrition.[1] Animal-source foods are nutritionally compact sources of energy, protein and various essential micronutrients. They matched well with the nutrients needs of people by supporting normal development, physiological functioning and overall good health. Micronutrients tend to be more bioavailable in animal-source foods and some such of vitamin B_{12} is found naturally only in animal-source foods. Consumption of even small amounts of animal-source foods has been shown to contribute substantially to ensuring dietary adequacy, preventing under-nutrition and nutritional deficiencies[2] and having positive impacts on growth, cognitive function, and physical activity of children, better pregnancy outcomes and reduced morbidity from illness.[3] Consumption of adequate amounts of micronutrientscould be found in animal-source foods, is associated with more competent immune systems and better immune responses.[4] Bangladesh is dominated by floodplains and rivers, which are rich ecosystems for freshwater fish. Fish is an essential and irreplaceable food in the Bangladeshi diet. As a source of major animal foods, fish provides both macro and micronutrients in Bangladeshi diet.[5] The biologically rich open water bodies include 260-500 species of inland fish, and some 75 of these species are regularly consumed by poor communities.[6][7][8] The value of fish in the Bangladeshi diet should not focus on the contribution made to protein, because protein recommendations in the typical diet are met provided that the energy recommendations are met.[9] Rather, focus should be placed on the composition of the fish and the contribution of micronutrients, especially vitamin A and minerals, from the different types of fish species. There are six major classes of nutrients: carbohydrates, fats, minerals, protein, vitamins, and water. These nutrient classes can be classified as either macronutrients (needed in relatively large amounts) or micronutrients (needed in smaller quantities). The macronutrients include carbohydrates (including fiber), fats, protein, and water. And the micronutrients are minerals and vitamins. The macronutrients (excluding water) provide structural material (amino acids from which proteins are built, and lipids from which cell membranes and some signaling molecules are built and energy. Carbohydrates and proteins provide 17 kJ approximately (4 kcal) of energy per gram[10] while fats provide 37 kJ (9 kcal) per gram. Vitamins, minerals, and water do not provide energy but are required for other reasons. **Proteins** are nitrogen-containing substances that are formed by amino acids. Proteins from animal sources (i.e. eggs, milk, meat, fish and poultry) provide the highest quality rating of foods sources. This is primarily due to the completeness of proteins from these sources. Although proteins from these sources are also associated with high intakes of saturated fats and cholesterol, there have been a number of studies that have demonstrated positive benefits of animal proteins in various population groups.[11][12][13] High animal protein diets have also been shown to cause a significantly greater net protein synthesis than a high vegetable protein diet.[13] The Institute of Medicine recommends that adults get a minimum of 0.8 grams of protein for every kilogram of body weight per day to keep from slowly breaking down their own tissues.[14] **Fats** consist of a wide group of compounds that are generally soluble in organic solvents and insoluble in water. Chemically fats are triglycerides: triesters of glycerol and any of several fatty acids. Fats are categorized as saturated and unsaturated. The source of saturated fats is animal foods. The latest Dietary Guidelines for Americans recommends getting less than 10% of calories each day from saturated fat.[15] Unsaturated fats are called good fats, because they can improve blood cholesterol levels, ease inflammation, stabilized heart rhythms and play a number of other beneficial roles. Unsaturated fats are predominantly found in foods from plants, such as vegetable oils, nuts, seeds and somemargarine, biscuits, cakes and other processed food. On the other handsaturated fats are found in meat, dairy and palm oil, which are considering least healthy. **Vitamins** are essential substances, which are necessary for normal health and growth supplied by foods. A vitamin is an organic compound required by an organism as a vital nutrient in limited amounts.[16] Vitamins are one of the most essential nutrients required by the human body and can be broadly classified either water soluble or fat-soluble. In human bodies there are 13 vitamins: 4 fat-soluble (A, D, E, and K) and 9 water-soluble (8 B vitamins and vitamin C).Water-soluble vitamins dissolve easily in water and in general are readily excreted from the body to the degree that urinary output is a strong predictor of vitamin consumption.[17] Because they are not as readily stored more consistent intake is important. Fat-soluble vitamins are absorbed through the intestinal tract with the help of lipids (fats), because they are more likely to accumulate in the body and to lead to hypervitaminosis than water-soluble vitamins. Fat-soluble vitamin regulation is of particular significance in cystic fibrosis.[18] **Vitamin A** is the name of a group of fat-soluble retinoids, including retinol, retinal, retinoic acid, and retinyl esters.[20][21][22] Animal sources of vitamin A are well absorbed and used efficiently by the body. Plant sources of vitamin A are not as well absorbed as animal sources. Two forms of vitamin A are available in the human diet: preformed vitamin A (retinol and its esterified form, retinyl ester) and provitamin a carotenoids.[20][21][22][23]Retinol is one of the most active or usable forms of vitamin A, and is

found in animal foods such as liver and whole milk and in some fortified food products. Retinol and retinyl esters are the dietary forms of preformed vitamin A. It can be converted to retinal and retenoic acid, other active forms of the vitamin A family.[24] Vitamin A deficiency is a major problem in Bangladesh, accounting for something like 30,000 children less than six years of age going blind each year, and at least half of these dying within weeks of the blinding episode National studies have confirmed widespread low intakes of vitamin A in the diet and high prevalence's of signs and symptoms of xerophthalmia. These prevalence are all well in excess of WHO threshold levels at which a major public health problem is considered to exist. Smaller, often clinically based studies have confirmed low serum retinol levels and interactions with diarrhoea, measles and other infectious disease including the presence of enteric parasites. Risk factors in the development of xerophthalmia include diet, age, infectious disease, maternal education, socioeconomic status seasonal variation and geographic clustering.[25] **B vitamins** are a group of water-soluble vitamins that play important roles in cell metabolism. In general, supplements containing all eight are referred to as a vitamin B complex: Vitamin B1 (thiamine), Vitamin B_2 (riboflavin), Vitamin B_3 (niacin or niacinamide), Vitamin B_5 (pantothenic acid), Vitamin B_6 (pyridoxine, pyridoxal, or pyridoxamine, or pyridoxine hydrochloride), Vitamin B- (biotin), Vitamin B, (folic acid), Vitamin B_{12} (various cobalamins). They are water-soluble vitamins that are not stored in the body and must be replaced each day. **Vitamin B_1 (Thiamine)** - found in cereals (rice, wheat, maida, rava, poha, etc.) breads, fortified cereals and pasta, pulses or lentils (dals such as moong dal, masoor dal, chana dal etc), legumes (whole pulses such as whole moong, channa, chowli, rajmah), dark green leafy vegetables such as spinach, fenugreek, lettuce, cabbage, asparagus etc. soy foods, whole grains like wheat germ, fish, egg, milk, meat, pork ham etc, nuts such as almonds and pecans.[19] **Vitamin B_2 (Riboflavin)** - some of the best sources of riboflavin are chicken, fish, eggs, legumes (like peas and lentils), milk and milk products such as yogurt and cheese, nuts, green leafy vegetables like spinach, broccoli, asparagus, and fortified cereals also supply significant amounts of riboflavin to the diet.[19] **Vitamin B_6 (Pyridoxine)** - All foods contain some vitamin B_6. The best vitamin B_6 sources are beef liver, chicken breast and liver, avocado, banana, unpeeled potato, meats and yeast. Other sources include eggs, fish, spinach, peas, broccoli, carrots, sunflower seeds, walnuts, wheat germ, and whole grains.[19] Food composition analysis provides detailed information about nutrients (e.g. protein, vitamins and minerals) and other important food components or bioactive compounds that are important for human nutrition. The current knowledge of nutrition is inadequate; more studies are still requiredin composition of foods and the role of the components and their interactions in health diseases.[26] Now-a-days, Bangladesh faces greatest nutritional challenges like other under developed countries, which can be explain as nutritional transition - under nutrition and over nutrition leads to paradoxical double burden of malnutrition. The current food composition table (FCT) of Bangladesh prepared long back; data which used are not relevant to our Bangladeshi dietary aspects. So this is very much essential to upgrade the food composition table with very recent valid data.

MATERIALS AND METHODS

To analyze the proximate composition, B-vitamins and retinol of the commonly consumed animal source foods of Bangladesh prioritized by "Key Foods" approach. Key foods identification was done by consumption-composition-consumption frequency. Among the "Key foods", the present study sample such as three cultured fish (Pangas, Rohu, Tilapia), farmed chicken (breast and leg portion), farmed chicken egg and milk (cow, pasteurized) were selected. There are 30 AEZ (agro-ecological zones) in Bangladesh categorized mainly in view of crop production. Food samples were collected from 2-3 sites of each division that automatically cover all major AEZ. Selected animal source foods sample were collected from 14 Haats across all seven divisions (considering 70% of rural population) and wholesale/retail markets of city corporation areas (considering 30% of urban population). Food samples collection was followed the stratified sampling frame. Sample was identified according to English name and scientific name. For preparation of composite sample, collected samples were washed with tap water followed by distilled and deionized water. Kitchen towel was used for soaking extra water and dried in air. For fish and chicken, bone was removed from flesh. Equal amount of sample of different place was taken and homogenized. By food processing, samples were weighed in plastic party dish and kept in -20°C for freeze drying. These composite samples were used for laboratory analysis. Proximate analysis for moisture, protein, total lipids, total ash were done according to the Association of Official Analytical Chemist (AOAC, 2000) from three cultured fish (Pangas, Rohu and Tilapia), farmed chicken (breast, leg) Egg (chicken, farmed), milk (cow, pasteurized). Moisture was determined according to the (AOAC). At first, weight of the crucible was made constant and 2-4 gm of fresh sample was taken in crucible. The crucible was then placed in an oven at 105°C for 3-4 hours. It was then cooled at room temperature in desiccators and weighed. The process of heating, cooling and weighting was repeated until the weight become constant. Methods used for crude protein estimation follows the principle that nitrogen content when multiplied by the factor 6.25 provide the value for crude protein. The estimation of nitrogen was made by modified kjeldahl method 984.13 (AOAC 2000) which depends on the fact that organic nitrogen when digested with conc. H2SO4 in the presence of catalyst (K2SO4: CuSO4.5H20 = 98:2) was converted into Ammonium Sulphate. NH3 liberated by making the solution alkaline was distilled into a known volume of standard acid (H2SO4) which was then back titrated with alkali

(NaOH). The sample (0.5-2.0 g) was taken in weighing paper and measured accurately. This sample was poured into a 500 ml clean and oven dried kjeldahl flask, to which 5g of digestion mixture and 25 ml of concentrated H2SO4 was added. To avoid frothing and bumping, a glass rod was placed inside the flask. A blank was carried with all reagents except sample material for the composition. The flasks were then heated in a kjeldahl digestion chamber initially at low temperature (40°C) until the mixture no longer frothed and then heating was increased to 60°C and heating continued until solution became colorless. At the end of digestion period, the flasks were cooled and diluted with 100 ml distilled water. A small piece of litmus paper was placed in the solution and the reaction was found to be acidic. The distillation set of kjeldahl apparatus was thoroughly washed with distilled water before starting the distillation. 25 ml of H2SO4 solution (0.1 N) was taken into the receiving flask (250 ml). Pumic stones were taken into ground joint flask to inhibit bumping during distillation. In a measuring cylinder, 75 ml of 40% NaOH was taken and it was carefully poured down the side of the ground joint flask. The mouth of the flask was closed with a stopper containing connective tube, which was ultimately connected to the ammonia receiving flask containing H2SO4 solution (0.1 N). The mixture was boiled at such a rate that water and ammonia distilled over at a steady moderate rate. The heating was not too slow so that the sulphuric acid solution might be sucked into the kjeldahl flask and not too fast so that the distilling ammonia escaped the sulphuric acid without absorption. The ammonia absorbed in the receiving flask containing 0.1 N H2SO4 was titrated with 0.1 N NaOH using 2 drops of methyl red as indicator. Similarly, a reagent blank was distilled and titrated. The Soxhlet procedure described in method non 991.36; AOAC 2000 was used to estimate total crude fat. The fat was extracted from the dried sample (5g) using petroleum ether (40-60 boiling range) as a solvent. The sample was taken into a filter paper, folded into square size and dipped into extraction tube. 200 ml of petroleum benzene was added to boiling flask Soxhelt extractor was extracted at a rate of 5 or 6 drops per second condensation. Each extraction lasted 16 hours. At the end the extraction was removed from the flask and initially dried to minimal volume in a hot water bath. It was transferred into a small pre-weighed flask followed by nitrogen flash to remove all traces of petroleum ether. The flask was then soaked with tissue paper to dry and then weighed. 3-5g sample was taken in a previously cleaned furnace dried and accurately weighed porcelain crucible. At first the crucible containing sample was placed in an oven (100 105°C) for 4 hours to remove moisture. The moisture free sample was completely charred followed by heating in a muffle furnace for 5-6 hours at 600°C (AOAC, 1998d). It was cooled in desiccators and weighed. To ensure complete combustion, the crucible was again heated in the muffle furnace for half an hour, cooled in desiccator and weighed again. This process was repeated until the ash became almost white, grayish in color and a constant weight was obtained. Thiamin and riboflavin content was determined by HPLC method and vitamin B6 was determined by microbial method from three cultured fish (Pangas, Rohu and Tilapia), farmed chicken (breast, leg) Egg (chicken, farmed), milk (cow, pasteurized). Vitamin B1 (thiamin) and vitamin B_2 (riboflavin) is determined by HPLC (High Performance Liquid Chromatograpy) method (AOAC, 2000). The vitamins were extracted from the food by acid hydrolysis followed by enzymatic hydrolysis. The aqueous extract was injected onto a reverse phase HPLC column. The fluorescence of riboflavin was measured and thiamin was determined after post column derivatisation with alkaline potassium ferricyanide that converts the thiamin to thiochrome. About 1 to 6 g dry sample was weighed or 10 ml of liquid sample was pipetted into a 125 ml Erlenmeyer flask. About 60 ml 0.1 N hydrochloric acid or > 10 times dry weight sample in grams was added to all flasks then cap with aluminum foil and mix. The flasks were placed in a boiling water bath for 30 minutes, with further mixing at 10 minutes intervals or autoclave mixture 30 minutes at 121°C. The flasks were removed from water bath, and then cool to below 50°C. 5 ml of 10% Taka diastase solution was added, capped flask, mixed and incubated in a 37°C water bath overnight or 45-50°C water bath for 3 hours with intermittent mixing. Then the flask was cooled to room temperature and quantitatively transferred into 100 ml volumetric flask and diluted to the volume with deionized water. Then the sample was filtered through filter paper and the filtrate was collected in a 125 ml Erlenmeyer flask. About 10 ml filtrate was passed through a 0.45 um filter unit and collected an aliquot into 5 ml amber glass vial which was ready for HPLC analysis. For standard curve, 10 ml of both thiamin and riboflavin standard stock solution was pipetted into 100 ml volumetric flask and diluted to the volume with water. About 5 ml was pipetted into a Erlenmeyer flask. The working standard was treated in the same way as samples including diluting to 100 ml final volume. For thiamin, the concentrations of calibrating standards (208.5 ng/ml, 417 ng/ml, 625 ng/ml, 834 ng/ml) was prepared from the extracted standard. For riboflavin, the concentrations of calibrating standards (10 ng/ml, 20 ng/ml, 30 ng/ml, 40 ng/ml) was prepared from the extracted standard. About 20 ml of each concentration was passed through a 0.45 um filter unit and collected an aliquot into 5 ml amber glass vial which is ready for HPLC analysis. Preparation of standard curves using calibrating standards Calibration graph was prepared from the calibrating standard concentrations versus peak height. The linearity of the proposed method was evaluated by using calibration curves to calculate coefficient of correlation, slope and intercept values. The content of B-vitamins (x) was calculated by using the plotted peak areas (y) of three samples of the each food sample, slope (m) and intercept (c) from the calibration curves of B vitamins standards in this equation, $y= mx + c$. The sample concentration was taken from the calibrating graph. Vitamin B6

(Pyridoxine) in foods has been determined by microbiological method (AOAC, 2000). Heating raw samples with diluted mineral acid under autoclaving conditions liberates the B_6 vitamin from their protein complex and also hydrolyses phosphorylated forms to the free vitamin. The process must be protected from light. This heat-treatment is necessary for the determination of total B. in foods because the assay organism, Saccharomyces carlsbergensis, utilizes only the non-phosphorylated form of vitamin. Pyridoxine Y medium: The medium was weighed according to an instruction on the label. The medium was suspending in an appropriate volume of deionized water and boiled for 2-3 minutes and cooled to room temperature before use. Stock culture of Saccharomyces carlsbergensis: The culture was streaked in 3 tubes of 5 ml PDA agar slant and incubated at 30°C for 24 hours. The tubes were stored at 4°C and subcultures every two weeks in triplicate. Saccharomyces carlsbergensis was subculture from a stock culture to a tube containing 5ml of micro inoculum broth and incubated at 30°C for 16 hours under aseptic condition. The culture was centrifuged at 2000 rpm for 10 minutes. Discard the supernatant was discarded and washed cells three times with 10ml of sterile normal saline solution (NSS) and centrifuged at 2000 rpm for 10 minutes. The last supernatant was discarded and diluted cell to an appropriate inoculum with sterile 0.85% NSS solution and mixed thoroughly.1 drop was used to inoculate the vitamin assay tubes. Edible portion of food sample was weighed. The sample is then homogenized and assayed immediately. About 4.023 g dry powder sample was weighed into a 250-ml Erlenmeyer flask. About 100 ml 0.055N HCI was added to all flasks and covered with aluminum foil and mixed thoroughly. The sample was autoclaved at 121°C for 3 hours and cooled at room temperature in running water. pH was adjusted to pH 4.6 with 3M CH3COONa and quantitatively transferred into a 200-ml volumetric flask. The sample was diluted to the volume with deionized water. Then filtered through filter paper and collected the filtrate in a 125-ml Erlenmeyer flask. A portion of the clear filtrate was diluted to concentration of about 6-10ng pyridoxine/ml. Pipette working standard was pipetted (4 ng/ml, standard to give a standard set of 0, 4, 8, 12, 16, and 20 ng/tube Assay tube Test solution (ml) Deionized water (ml) Assay medium (ml) After mixing, the tubes were sterile by autoclave at 121-123°C for 10 min and cooled to room temperature in running water. The diluted inoculums were mixed thoroughly. Using a sterile Pasteur pipette, under aseptic condition, one drop of the diluted inoculum was inoculated into the vitamin assay tubes, except the inoculated blank and mixed thoroughly on a vortex mixture. The whole set of tubes was incubate at 30°C in shaking water bath or sloping the rack at 60°C for 16-18 hours and check the turbidity regularly after 16 h incubation Growth of the test organisms was stopped by boiling at 100°C, 5 min and cooled in running water; the content of each tube was mixed thoroughly. About 30 second was stand before measuring the turbidity of growth by reading the optical density at any specific wavelength between 650 nm. A standard growth curve was prepared by plotting the series of standard concentrations of vitamin on x basis versus corresponding optical density (OD) on y basis. The standard curve was drawn and read the concentration of vitamin in the unknown tubes from the linear part of the standard curve Riboflavin was determined by HPLC method from three cultured fish (Pangas, Rohu and Tilapia), farmed chicken (breast, leg) Egg (chicken, farmed), milk (cow, pasteurized). Vitamin A (retinol) was determined by HPLC method (ASEAN Manual of Nutrient Analysis, 2011). After homogenization and saponification of the material under investigation in a solution of ethanolic potassium hydroxide, the retinol (vitamin A alcohol) released was totally extracted with organic solvents. Separation of the retinol was done with part of the extract by reversed-phase HPLC. Quantitation was carried out against an external vitamin A standard that has undergone the same procedure as the sample 1 mg of retinol was weighed into a 100 ml volumetric flask and small amount of chloroform was dissolved until all retinol was dissolved, then diluted to mark with ethanol and mixed. This solution was diluted ten times in another volumetric flask. Absorbency of this final solution was read with UV-spectrophotometer at 325 nm and concentration of retinol was calculated by extinction coefficient E (1% in ethanol at 325 nm) = 1850 (1835). This final solution was diluted further to a concentration of about 0.2-1.0 ug/ml. The sample was comminuted as finely as possible (e.g. using chopper, mincer, etc.) and homogenized. It was analyzed immediately and quickly. When this cannot be done, the homogenized sample was placed in brown bottle, flush with nitrogen, sealed and stored in freezer until use for analysis.1. Preparation of standard calibration curve Calibration curve was prepared for vitamin A, by injecting different concentration (2 ug/ml, 4 ug/ml, 6 ug/ml, 8 ug/ml, 10 ug/ml) of vitamins into the HPLC and plotting a curve of amount of vitamin versus peak area (or peak height). The linearity of the proposed method was evaluated by using calibration curves to calculate coefficient of correlation, slope and intercept values. The content of vitamin A (x) was calculated by using the plotted peak areas (y) of two or three samples of the each food sample, slope (m) and intercept (c) from the calibration curves of vitamin A standards in this equation, $y = mx +$ calibration curve was prepared, read the amount of retinol (ug/ml) from calibration curve and calculated to ug.

RESULTS

In present study, composite sample of three different cultured fishes, farm chicken (two portions), egg and milk are analyzed for proximate, B-vitamins (vitamin B_1, B_2 and B_6) and retinol contents. The results of analyzed foods sample are presented by nutrient compositions.

Table 1: Mean proximate nutrients composition (g/100g EP) of three cultured fish on fresh weight basis.

Food name	Scientific name	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Ash (g/100g)	CHO (g/100g)	Energy (Kcal)
Pangas, without bone, raw	Pangusius pangasius	70.8	15.9	11	1.0	0.0	162.0
Rohu, without bone, raw	Labeo rohita	76.3	20.6	2.6	0.9	0.0	105.8
Tilapia, without bone, raw	Oreochromis mossambicus	76.2	20.8	3.0	1.1	0.0	110.2

As shown in table 1, the moisture content of Pangas, Rohu and Tilapia are 70.8g, 76.3g, 76.2g, protein 15.9g, 20.6g and 20.8g, fat 11.0g, 2.6g and 3.0gper 100g respectively. In terms of moisture, protein and fat content Rohu and Tilapia composition are quite similar, whereas Pangas contain higher fat (11.0 g) and lower protein content (15.9g). Energy value of Pangas, Rohu and Telapia are 162.6 Kcal, 105.8 Kcal and 110.2 Kcal. As Pangas contain much higher fat, energy values is higher than other two fishes. In terms of fat Rohu and Tilapia are better than Pangas. Ashcontent of Pangas, Rohu and Tilapia are 1.0g, 0.9g and 1.1g respectively that are almost same.

Table 2: Contents of B vitamins (mg/100g EP*) of three fish on fresh weight basis.

Food name	Scientific name	Thiamin (mg/100g)+SD*	Riboflavin (mg/100g)+SD*	Vitamin B6 (mg/100g)+SD*
Pangas, without bone, raw	Pangusius pangasius	0.151± 0.01	0.056 ± 0.03	0.106 ± 0.02
Rohu, without bone, raw	Labeo rohita	0.611 ± 0.05	0.102 ± 0.04	0.111 ± 0.01
Tilapia,without bone, raw	Oreochromis mossambicus	0.970 ± 0.04	0.088 ±0.03	0.111 ± 0.02

In shown table 2, thiamin content Tilapia (0.970mg), Rohu (0.611mg) and Pangas (0.151mg). Riboflavin 0.056mg, 0.102mg, and 0.088mg Riboflavin content of Pangas is almost half of Rohu. Vitamin B6 content of Pangas, Rohu and Tilapia are 0.106mg, 0.111mg and 0.111mg that are almost same. In terms of these three B-vitamins, Rohu and Tilapia have higher values than Pangas.

Table 3: Contents of retinol (ug/100g EP) and fat (g/100g) of three fish on fresh on fresh weight basis.

Food name	Scientific name	Retinol (ug/100g)	Fat (g/100g)
Pangas, without bone, raw	Pangusius/pangasius	5.143	11
Rohu, without bone, raw	Labeo rohita	3.193	2.6
Tilapia,without bone, raw	Oreochromis/mossambicus	2.003	3.0

As shown in 3 tables, retinol content of Pangas, Rohu and Tilapia are 5.143ug, 3.193ug and 2.033 ug. Retinol content of Pangas is relatively higher in Pangas and low in Tilapia. Comparison of fat and retinol content of Pangas, Rohu and Tilapia indicates that high retinol content of Pangas fish may be due to high fat content. Results of nutrient composition of two portion of chicken (breast and leg) are presented in a tubular form. Findings of proximate, B-vitamins and retinols analysis are presented in table 3.4, 3.5 and 3.6 respectively.

Table 4: Mean proximate nutrients (g/100 g EP*) of chicken (breast and leg) on fresh weight basis.

Food name	Scientific name	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Ash (g/100g)	CHO (g/100g)	Energy (Kcal)
Chicken breast, without skin, raw	Gallus/ bankiva /murghi	72.9	22.3	1.8	1.1	0.0	105.4
Chicken leg without skin, raw	Gallus /bankiva /murghi	71.9	19.2	5.7	1.0	0.0	128.1

As shown in table 4, moisture content of chicken breast and leg are 72.9g and 71.9g. Ash (equivalent to total mineral) content of chicken breast and leg are 1.1g and 1.0g. Moisture and ash content of two portion of chicken are almost same. Protein content of chicken breast and leg are 22.3g and 19.2g respectively. Protein content of chicken breast is slightly higher than chicken leg (19.2g). Fat content of chicken breast and leg are 1.8g and 5.7 g respectively. Fat content of chicken leg is higher than chicken breast. As chicken leg contains much higher fat, energy values (128.1 kcal) per 100g edible portion is higher than chicken breast (105.4 Kcal).

Thiamin and riboflavin were determined in triplicate estimation, whereas vitamin B6 was determined in duplicate estimation. The results are presented in table 3.5.

Table 5: Contents of B-vitamins (mg/100g EP*) of chicken (breast, leg) on fresh.

Food name	Scientific name	Thiamin (mg/100g)+SD*	Riboflavin (mg/100g)+SD*	Vitamin B6 (mg/100g)+SD*
Chicken breast, without skin, raw	Gallus bankiva murghi	0.122± 0.01	0.073 ± 0.03	0.315
Chicken leg without skin, raw	Gallus bankiva murghi	0.090 ± 0.03	0.118 ± 0.04	0.350

As shown in table 5, thiamin content of chicken breast and leg are 0.122mg and 0.090mg respectively. Thiamin content of chicken breast is higher than leg. Riboflavin content of chicken breast and leg are 0.073mg and 0.118mg. Chicken leg contains higher riboflavin than breast. Vitamin B_6 content of chicken breast and leg are 0.315mg and 0.350mg that are almost same.

Table 6: Contents of retinol (ug/100g EP) of chicken (breast and leg) on fresh weight basis.

Food name	Scientific name	Retinol (ug/100g)
Chicken breast, without skin, raw	Gallus bankiva murghi	25.152± 1.5
Chicken leg without skin, raw	Gallus bankiva murghi	22.802 ± 1.4

As shown in table 6, retinol content of chicken breast and leg are 25.152ug and 22.802ug. Chicken breast contains higher retinol than chicken leg. Egg and milk are known as the ideal food for growing children. They are rich source of basic nutrients needed for growth and development.

Table 7: Mean proximate nutrients (g/100 g EP*) of egg and milk on fresh weight basis.

Food name	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Ash (g/100g)	CHO (g/100g)	Energy (Kcal)
Egg, chicken, raw	72.3	14.5	9.0	0.08	0.0	139.0
Milk, cow, whole fat (pasteurized UHT*)	88.3	3.1	3.7	0.06	4.3	63.0

As shown in table 7, Moisture content of egg and milk are 72.3g and 88.3 g respectively. Protein content of egg and milk are 14.5g and 3.1g respectively. Fat content of egg and milk are 9.0g and 3.7g. Among the proximate nutrients egg contain higher amount of protein and fat than milk. As fat content of egg much higher, the energy value of egg 139 Kcal per 100g is higher than milk (63 Kcal). On the other hand, milk contains 4.3g of available carbohydrate per 100g. Ash content of egg and milk are 0.08 and 0.06 that are almost same.

Table 8: Contents of B-vitamins (mg/100g EP*) of egg and milk on fresh weight basis.

Food name	Thiamin (mg/100g)+SD*	Riboflavin (mg/100g)+SD*	Vitamin B6 (mg/100g)+SD*
Egg, chicken, raw	0.184± 0.040	0.187 ± 0.001	0.230
Milk, cow, whole fat (pasteurized UHT*)	0.062 ± 0.040	0.276 ± 0.010	0.053

As shown in table 8, thiamin content of egg and milk are 0.184 mg/100g and 0.062 mg/100g respectively. Thiamin content of milk is almost one third of egg. Riboflavin content of egg and milk are 0.187 mg/100g and 0.276 mg/100g respectively. Milk contains higher riboflavin than egg. Vitamin B_6 content of egg and milk are 0.230mg/100g and 0.053 mg/100g. Egg contains almost four times higher vitamin B_6 as compare to milk.

Table 9: Contents of retinol (ug/100g EP) of egg and milk on fresh weight basis.

Food name	Retinol (ug/100g)
Egg, chicken, raw	165.246± 1.1
Milk, cow, whole fat (pasteurized UHT*)	30.177 ± 0.2

As shown in table 9, retinol content of egg and milk are 165.246ug and 30.177ug respectively. Egg contains higher retinol than milk as well as all samples.

DISCUSSION

The outcomes of successful social and economic development are depending on healthy well-nourished

people. Good health needs balanced diets, which could be obtained and designed by the accurate information regarding nutrient composition of foods. It is important to analyze and generation the data for various nutrients of food that are required for the maintenance of good health. Bangladesh is experiencing a long-term change in food supply with the emergence of HYV (*High Yeilding Varieties*) newer foods as well as change in soil composition due to environmental changes, increased use of fertilizers and crop intensity resulting in possible alterations in their nutrient composition. Bangladesh as a riverain country, rivers have been the major source of fish production in Bangladesh from time immemorial. Naturally, due to geographical location fish plays a major role in traditional Bangladeshi diet as a most available source of animal protein. Now a day, cultured fish has become more popular due to their high productivity and to fulfill the demand with tremendous population growth. Three different cultured fish (*Pangusius pangasius, Labeo rohita, Oreochromis mossambicus*) commonly consumed in Bangladesh were analyzed for the determination of nutritional composition. Similarly, farmed chicken is another animal protein source and available more due to large scale production and replaced the indigenous varieties. The present study estimates concentrations of nutrients (proximate, Vitamin-B and retinol) from nationally representative composite samples of six animal protein source of Bangladesh. Because the authentic data on the nutrient composition of foods for human consumption are critical for many areas of endeavor including health assessment, formulation of appropriate institutional and therapeutic diets, nutrition education, food and nutrition training, epidemiological research on the relationship between diet and diseases, plant breeding, nutrition labeling, food policy and regulation, and consumer protection, as well as for a variety of application in agriculture, trade, research, development and assistance. Proximate composition of analyzed cultured fishes shows that the protein content of Pangas is 15.90 g. According to DKPM[27] (Deshio Khaddar Pustiman) and UK[28] food composition database, protein content of Pangas is 14.2g that is comparable to the present result. Protein content of Rohu is 20.60g that is comparatively higher than reported value in UK (United Kingdom)[28] database (16.6g). Whereas, Tilapia fish contains 20.80 g protein USDA[29] (United Sates Department of Agriculture) and UK[28] database reported the protein content of Telapia is 20.08g and 17.8g respectively. Obtained result is more close to the USDA value. The present study findings show that fat content of Pangas is 11.0g. According to DKPM[27] and UKS database, fat content of Pangas is 10.8g, which is more close to obtained result. Rohu contains 2.6 g of fat per 100g of edible portion, is higher than the value reported in UK[28] database (1.4g). Fat content of Tilapia is 3.0g, which is almost double as compared to value presented in UK[28] database (1.5g) and USDA[29] (1.7g).Proximate analysis of farmed chicken has been done according to the portion wise e.g. breast and leg portion. Protein content of chicken breast is 22.3g of edible portion. USDA[29] and Danish database[30] reported value is 21.23 mg and 20.3 g respectively and obtained result of present study is comparable to USDA and Danish database value. Similarly, protein content of chicken leg was 19.2g is very close to USDA[29] (19.16g) whereas, Danish database[30] reported the range of value from 20.9 to 25.0 mg. Chicken breast contains 1.8 g fat per 100g of edible portion that is lower than Danish[30] database (2.70g) and USDA[29] (2.59g) per 100g. Fat content of chicken leg (5.7g), is slightly higher than the value reported in USDA[29] (4.22g) and with the range reported in UK[28] database (2.8-8.4g). Proximate analysis of egg (chicken, farmed) shows that protein content of egg is 14.5g. DKPM[27], USDA[29], UK[28] and Danish database[30] has been reported the value per 100g as 13.3g, 12.6 mg, 12.5g, 12.6g respectively that is comparable to the obtained result. The present study shows that milk (cow, pasteurized) contains 3.1g protein per100g. According to DKPM[79], UK[80] and Danish database[30], protein content of milk is 3.2g, 3.3g and 3.4-3.5g per100g respectively. Obtained result is strongly comparable to the above mentioned databases. Fat content of egg is 9.0 g. According to DKPM[27], USDA[29], UK80 and Danish database[30], fat content of egg is 13.3g, 9.5g, 1.2g and 9.9gper 100g respectively. Present study finding is more close the value reported in USDA and Danish database. Milk fat contained is 3.7g fat, is close to UK[28] (3.9 g) and Danish database[30] (3.5-3.6g) whereas, DKPM[27] (4.1 g) reported value is higher than the present study findings B-vitamins analysis of three cultured fish shows that thiamin, riboflavin and vitamin B_6 content of Pangas is 0.151mg, 0.056mg and 0.106 mg per100g respectively. Regional and other database has no value for thiamin, riboflavin and vitamin B_6 of Pangas Rohu contains 0.611 mg thiamin per 100 g of edible portion, which is much higher than UK database[28] (0.05 mg). Similarly, Thiamin content of Tilapia (0.970mg) is also very high as compare to USDA (0.04mg)[29] and UK database[28] (0.03 mg). Riboflavin content of Rohu is 0.102mg. UK database[80] reported that riboflavin content of Rohu is 0.070 mg that is comparable to the obtained result. Tilapia contains 0.088 mg riboflavin per 100g of edible portion that is almost same to UK database[28] (0.09mg) whereas USDA reported the value is slightly lower than present study (0.063 mg). Due to the lack of information on vitamin B_6 content of Rohu fish comparison of vitamin B_6 of Rohu fish with other database can't possible. Tilapia contains 0.111 mg vitamin B_6 per 100g of edible portion that is slightly lower than the reported value of USDA[29] (0.162 mg). B-vitamin of farmed chicken has been analyzed according to portion wise (eg. breast and leg). Thiamin content of chicken breast is 0.122 mg that is double to USDA[29] (0.064 mg) and Danish database[30] (0.085 mg). Chicken leg contains 0.090 mg thiamin per 100g is same to USDA[29] (0.090 mg) whereas UK database[28] reported the range of value from 0.05mg to 0.14 mg. Riboflavin content of chicken breast is 0.073mg which is close to USDA[29] (0.100 mg) whereas Danish database 82

reported value is 0.170 mg. Similarly, riboflavin content of chicken leg is 0.118 mg that is lower than USDA[29] (0.180 mg) and UK[28] database (0.130-0.220 mg) Vitamin by content of chicken breast is 0.315 mg that is much lower than USDA[29] (0.749mg). Vitamin B_6 content of chicken leg (0.350 mg) is close to USDA[29] reported value (0.406 mg). Analysis of B-vitamin in egg (chicken, farmed) and milk (cow, pasteurized) shows that thiamin content of egg is 0.184mg that is almost double to the UK database (0.090mg) whereas Danish database[30], DKPM[27] and USDA[29] reported value is 0.070mg, 0.010mg and 0.040 mg respectively. Thiamin content of milk shows 0.062 mg thiamin per 100g. DKPM[27], UK[28] and Danish[30] database reported that 0.05 mg, 0.03 mg and 0.42-0.45 mg respectively. Obtained result of present study is close to DKPM. Riboflavin content of egg (0.187 mg) is much higher than Danish, DKPM[27], UK[28] and USDA[29] database reported value (0.450 mg, 0.400mg, 0.470mg and 0.457mg in per 100 g respectively). Riboflavin content of milk is 0.276 mg. DKPM[27], UK[28] and Danish[30] database value is 0.190mg, 0.230mg and 0.173-0.203 mg per 100 g. Obtained result is close to UK database. Vitamin B_6 content of egg is 0.150 mg that is close to USDA[29] (0.170 mg). Regional and other database has no value for vitamin B_6 of milk. Retinol analysis in three cultured fish shows retinol content of Pangas, Rohu and Tilapia are 5.143 ug, 3.193 ug and 2.033 ug in per 100 g respectively. UK[28] database reported that negligible amount of retinol in Rohu. There is no retinol value database of Pangas and Tilapia in other data bases. Retinol of farmed chicken has been analyzed according to portion wise (eg. Breast and leg). Retinol content of chicken breast is 25.152 ug, which is much higher than USDA[29] (9.0 ug) and Danish[30] database (9.0 ug). Chicken leg contains 22.802 ug retinol per 100g that is almost double to the USDA[29] (10.0 ug) whereas is closer to the UK[28] database (15-20 ug). Analysis of retinol in egg (chicken, farmed) and milk (cow, pasteurized) shows that retinol content of egg is 165.246 ug. UK[28] database, Danish database[30] and USDA[29] reported value is 190 ug, 240 ug and 160ug respectively. Obtained result is close to USDA.[29] Milk contains 30.177ug thiamin per 100g that is present within the range of Danish[30] (29.6-31ug) and UK[28] (30-33ug) database. The data presented in this thesis are providing nutrient information of selected foods consumed by most of the Bangladeshi people and are considered essential information required for improving food security, nutrition and health.

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