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Sustainability of Human Nutrition through Poultry Meat and Egg

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ABSTRACT: This paper investigates the importance and sustainability of poultry meat and egg in human nutrition. The role of poultry meat and egg is an undisputable fact and has always been an integral part of human nutrition. Apart from the various health benefits, the rearing of bird is also a major point in the eradication of poverty among the rural population. The benefits of chicken meat consumption on various factors *viz.*, maintenance of body weight, body tone, bones and teeth, metabolism, and protection from cancer were examined. Also, the myths about consumption of chicken meat and broiler are reviewed in detail. In addition, the benefits of egg consumption are illustrated with many health attributes *viz.*, Strong muscles, brain health, energy production, healthy immune system, risk of heart disease, healthy pregnancy, eye sight, weight loss and maintenance and skin benefits. It can be concluded that a comprehensive search of peer – reviewed databases revealed that poultry meat and egg production have the power to alleviate/eradicate poverty among the developing nations through various schemes for rearing of rural poultry. This would help in decreasing the malnutrition by making the availability of "poultry protein". Further research is needed to explore optimal intervention of predictive modelling, artificial Intelligence and IoT technologies to identify the popularization on the production and consumption of poultry and its products.

Keywords: Poultry meat and Egg, Consumption, Nutrition, Myth, Health, Broiler.

INTRODUCTION

The poultry farming has undergone a sea change during the past 6 to 7 decades. According to Chatterjee and Rajkumar (2015), Poultry is one of the fastest growing segments of the agricultural sector in India with around eight percent growth rate per annum., the poultry sector in India has undergone a paradigm shift in structure and operation which has been its transformation from a mere backyard activity into a major commercial Agri based industry over the period. The constant efforts in upgradation, modification and application of new technologies paved the way for the multi fold and multifaceted growth in poultry and allied sectors (Dutta & Singh 2014). The development is not only in size but also in productivity, sophistication, and quality. Development of high yielding layers (310- 320 eggs) and broilers (2.1-2.5 kg at 5 wks) varieties together with standardized package of practices on nutrition, housing, management and disease control have contributed to spectacular growth rates in egg (6-7% per annum) and broiler production (8-10% per annum) in India during the last 50 years. The annual per capita availability has also increased to 103 eggs and 3.1 kg of meat, consistently with increase in productivity. However, it is far below the recommended level of consumption of 180 eggs and 10.8 kg poultry meat per person per annum by ICMR (Reddy & Kumar 2016). This transformation has involved sizeable expansions and investments in breeding, hatching, rearing, and processing. The growth of the poultry sector in India is also marked by an increase in the size of the poultry farm. Small units are probably finding themselves at a disadvantage because of high feed and transport costs, expensive vaccines, and veterinary care services and the non-availability of credit. Some small units are reported to be shifting from layer to broiler production because output in broiler units can be realized in six weeks. The structure of India's poultry industry varies from region to region. While independent and relatively small-scale producers account for the bulk of production, integrated large-scale producers account for a growing share of output in some regions. The southern region account for about 57 percent of the country's egg production, the eastern and central regions of India account for about 17 percent, the northern and western regions contribute 26 percent of egg production. India has nearly 70% of its population living in rural areas. However, in the present scenario most of the commercial poultry production is concentrated in urban and peri – urban areas. Just 25% population living in urban areas consume about 75-80 % of eggs and poultry meat. Non-availability of poultry products and low purchasing power of the rural people devoid them of access to the highly nutritious products like egg and meat, thereby, resulting in malnutrition (Sharma *et al.*, 2018). Successful schemes have been implemented utilising

the desi fowl for the poverty alleviation. One such scheme has been successfully implemented in Uttarakhand using the Uttara fowl (Kamboj & Kashyap 2022) An important sector of poultry is commercial production, but it retains some characteristics of the traditional, backyard systems, particularly in selling live birds in wet markets or directly to retail shops. Levels of biosecurity are low, in that birds are often not permanently housed, mixed flocks of chickens and waterfowl may be kept, birds are generally marketed live, and a range of different markets, un-monitored for health risks, are used for produce sales and input supplies. In the industrial and integrated production system, it is the largest and most industrialized (more than 1.00 lakh birds) enterprises in the poultry industry. The various stages in the value chain are vertically integrated into a single industrial company. The Indian poultry sector has enormous potential to grow and shape the future of the country's food and agricultural sectors. The industry has already expanded significantly over the last decade, and with suitable policies and strategies, it can continue to grow and contribute to the country and economic progress. It can be used as a powerful tool for alleviation of rural poverty, eradication of malnutrition and creation of gainful employment in vast rural areas (Sharma and Chatterjee 2009; Rajkumar *et al.,* 2010). The National Nutrition Monitoring Bureau (NNMB) of India showed that the occurrence of under-nutrition amongst children and chronic energy deficiency (CED) amongst other individuals alarmingly higher than the late nineties, even if slow decline and their incidence is closely associated with poverty. Stunting and wasting in children less than five years of age and slow mental development were seen in rural area because of scarce dietary energy and protein. Pregnant and lactating woman and young children are more exposed. Therefore, improvement in food consumption is an essential for overcoming the problem of malnutrition in India. Desi chicken rearing is a very good venture to empower the rural folks financially and socially (Balaji *et al.,* 2023).

IMPORTANCE OF POULTRY IN HUMAN NUTRITION (MEAT AND EGG)

Poultry meat eggs are vital components of human nutrition, offering high – quality protein and essential nutrients crucial for overall health. The bulk of daily human food comprises mainly of carbohydrates, protein, fat, minerals, vitamins and water. Usually, the human diet is not so deficient in terms of availability of minerals, vitamins, carbohydrates and water. The main deficient portion is the protein, especially the animal protein (Sanlier & Üstün 2021). There are many sources of animal proteins like milk and milk products, chevon, mutton, fish, egg, pork, beef, chicken meat, etc. The animal protein contains essential amino acids which are required for body growth and maintenance. The digestibility and the contents of essential amino acids in egg and poultry meat is far more superior than any other sources of animal protein (Ruxton *et al.,* 2010).

Poultry meat. Poultry meat is commonly accepted as a good source of high-quality protein, B- vitamins and minerals. Turkey meat is lower in fat than chicken, while goose and duck meat are higher in fat. When skin is present, the fat level is higher because skin includes subcutaneous fat. When fat content goes up, moisture is reduced and therefore, it is commonly said that there is an inverse relationship between moisture and fat content. The protein content is not much affected by this change. Higher fat also translates into higher caloric value, but in general, poultry meat is considered to be a lean meat when compared to red meat sources. Another important difference is that poultry fat is less saturated than beef and pork fat and therefore it is considered to be a more favourable meat. The higher unsaturation also results in a lower melting point of the fat. This also has an implication regarding fat stability to lipid oxidation (*i.e.,* a higher degree of unsaturation makes the fat less stable) and allowable chopping temperature when preparing a meat emulsion. Overall, poultry meat consumers can obtain a very lean product by excluding the skin because, unlike red meat animals, most of the fat is subcutaneous. Poultry meat is ideal food for infants, young children, adolescents, adults, old people, convalescents and those attempting to control their weight. Because of its high meat yield, low shrinkage during cooking and ease of cooking and serving, poultry meat fits well on the menu of restaurants, hotels, airlines, hospitals, schools and institutions.

A major advantage of eggs and chicken meat as human food is that there are no major taboos on their consumption. Chicken meat is not only healthy but also the cheapest of all the livestock meats. Majority of urban people diet have more animal protein than that of rural people, because urban people are more aware about their diet and health (Marangoni *et al*., 2015).

BENEFITS OF CHICKEN MEAT CONSUMPTION

High-Quality Protein and Essential Amino Acids: Poultry meat is an excellent source of high-quality protein that provides all essential amino acids necessary for muscle synthesis, repair, and overall metabolic function. This makes it especially valuable for maintaining lean body mass and supporting recovery in athletes and older adults (Wang *et al.,* 2012).

Low in Fat and Favorable Fatty Acid Profile: Skinless poultry meat, particularly chicken breast, is relatively low in total fat and saturated fat compared to red meats. Its lean composition and favorable fatty acid profile contribute to better cardiovascular health by supporting healthier blood lipid levels (Santana *et al.,* 2014).

Rich in Essential Vitamins and Minerals: Poultry meat is a significant source of B vitamins (notably B6 and B12), phosphorus, selenium, and zinc. These micronutrients play critical roles in energy metabolism, immune system function, and neurological health.

Supports Weight Management and Satiety: The high protein content in poultry meat enhances satiety, which can help reduce overall calorie intake. This property

supports weight management efforts and assists in preserving lean body mass during energy-restricted diets (Foster *et al.*, 2003).

Cardiovascular Health Benefits: Replacing higher-fat red meats with lean poultry meat is associated with a reduced risk of cardiovascular diseases. The lower intake of saturated fats, along with the beneficial nutrient profile, helps improve blood cholesterol levels and overall heart health (Mente *et al.*, 2009).

Myths about the consumption of chicken meat:

Chicken meat contains harmful hormones and steroids: It is often believed that hormones or steroids are used in poultry production to enhance growth, making chicken meat unsafe for consumption - Regulatory authorities in many countries strictly prohibit the use of growth hormones in poultry. Comprehensive reviews of production practices confirm that, under current regulations, hormone usage in chicken farming is either banned or tightly controlled. Studies have shown that routine monitoring of chicken meat samples does not detect hormone residues at levels of concern (Rasmussen *et al.*, 2017).

Chicken meat with antibiotic residues: Many consumers worry that chicken meat contains unsafe levels of antibiotic residues due to routine use in poultry farming - Published research indicates that when proper withdrawal periods are observed, antibiotic residues in chicken meat remain within internationally accepted safety limits (Lee *et al*., 2019). Monitoring programs in regions with stringent regulations (such as in parts of Europe and North America) consistently report residue levels that are far below maximum residue limits (MRLs) (Kumar *et al*., 2018).

Chicken meat consumption increases cancer risk. Some myths about, eating chicken meat could raise the risk of developing cancer - A meta-analysis published in a peer-reviewed journal found that the epidemiological evidence does not support a direct link between chicken meat consumption and an increased cancer risk (Zhang *et al.*, 2017). Reviews focusing on poultry consumption have consistently reported that moderate intake of chicken is not associated with higher rates of cancers such as breast or ovarian cancer (Chen *et al.*, 2018).

Poultry eggs. The egg is one of the most complete and versatile foods available on this earth (Dowarah, 2013). It consists of approximately 10% shell, 58% white and 32% yolk. Neither the colour of the shell nor that of the yolk affects the egg's nutritive value. The average egg provides approximately 313 kilojoules of energy, of which 80% comes from the yolk. The nutritive content of an average large egg (containing 50 g of edible egg) includes: 6.3 g protein, 0.6 g carbohydrates and 5.0 g fat. Egg protein is of high quality and is easily digestible. (Anonymous 2002) Almost all of the fat in the egg is found in the yolk and is easily digested. Eggs contain every vitamin except vitamin C. They are particularly high in vitamins A, D, and B12 and also contain B1 and riboflavin. Eggs are a good source of iron and phosphorus and also supply calcium, copper, iodine, magnesium, manganese, potassium, sodium, zinc, chloride and sulphur. All these minerals are present as organic chelates, highly bioavailable, in the edible part of the egg (Myers and Ruxton 2023). Eggs are also a rich supply of omega-3 fatty acids. These are predominantly in the form of docosahexaenoic acid (DHA), which helps with the maintenance of brain function and normal vision (Ruxton *et al.*, 2010).

BENEFITS OF EGG CONSUMPTION

Rich Nutrient Profile: Eggs are an excellent source of high-quality protein and essential nutrients, including B vitamins, folate, unsaturated fatty acids, fat-soluble vitamins (E, D, A, and K), choline, and various minerals.

Cardiovascular Health: Moderate egg consumption (up to one egg per day) has not been associated with an increased risk of cardiovascular diseases in healthy individuals. Some studies suggest that egg intake may contribute to a decreased risk of stroke (Zhang *et al.*, 2020).

Metabolic Benefits: Egg consumption may protect against metabolic syndrome by increasing high-density lipoprotein cholesterol (HDL-C) levels and reducing inflammation (Sanlier & Üstün 2021).

Weight Management and Satiety: Emerging evidence indicates that eating eggs is associated with increased satiety, aiding in weight management and contributing to better diet quality (Ruxton *et al.*, 2010).

MYTHS ABOUT EGG CONSUMPTION

Eggs Increase Blood Cholesterol and Cardiovascular Risk: For many years, eggs were blamed for raising blood cholesterol levels and, by extension, increasing the risk of heart disease. However, multiple systematic reviews and meta-analyses have demonstrated that moderate egg consumption does not significantly affect blood cholesterol levels in most healthy individuals. For example, a meta-analysis by Rong *et al.* (2013) involving numerous prospective cohort studies found no significant association between egg consumption and the risk of coronary heart disease or stroke. Similarly, a review by Blesso (2015) in *Nutrients* concluded that eggs can be part of a heart-healthy diet without adverse effects on cardiovascular risk.

Brown Eggs Are More Nutritious Than White Eggs: A frequent belief is that brown eggs offer superior nutritional value compared to white eggs. In reality, the shell color is simply a function of the hen's breed and does not affect the egg's nutrient composition. Research comparing brown and white eggs has consistently shown negligible differences in protein, fat, and micronutrient levels. Zhao *et al.* (2010) reported in the *Journal of Food Composition and Analysis* that the nutrient profiles of brown and white eggs are virtually identical, confirming that shell color is not a reliable indicator of egg quality (Zhao *et al.*, 2010).

Raw Eggs Are More Nutritious Than Cooked Eggs: Another common myth is that raw eggs retain more nutrients than cooked ones. While it is true that certain heat-sensitive nutrients might be reduced during cooking, the overall benefits of cooking eggs are twofold. First, cooking enhances the digestibility of egg proteins, making the amino acids more bioavailable.

Mutungi *et al*., (1995) found that the protein in cooked eggs is significantly more digestible than in raw eggs. Second, cooking eggs minimizes the risk of foodborne illnesses, such as salmonellosis, which is a serious concern with raw egg consumption.

Eggs Contribute to Weight Gain: Some individuals avoid eggs, fearing that their fat and cholesterol content might lead to weight gain. Contrary to this belief, eggs are high in high-quality protein and other nutrients that promote satiety—helping to control appetite and reduce overall calorie intake. A randomized controlled trial by Vargas *et al*. (2016) published in the *International Journal of Obesity* demonstrated that including eggs in a weight loss diet increased satiety and improved adherence to the diet without leading to weight gain (Vargas *et al*., 2016).

CONCLUSIONS

The poultry meat and egg have the power to alleviate / eradicate poverty among the developing nations. Even, in our country various state government and even the central government have formulated many popular schemes for rearing of rural poultry. This will help in decreasing the malnutrition by making the availability of "poultry protein." Poultry is the only successful enterprises that has proven to be the game changer in poverty eradication. The same has been repeatedly endorsed by United Nations. Various events are conducted worldwide to popularise the production and consumption of poultry and its products.

FUTURE SCOPE

Poultry is poised to play a major role in improving the nutritional status of a common man due to its high advantages which can never be found in other meat. The poultry meat and egg is most affordable commodity, easily available and highly nutritious.

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