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Nutritional Value of Eggs in Human Diet

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ABSTRACT

Poultry is one of the most widespread food industries worldwide. Chicken is the most farmed species, with over 90 million tons of chicken meat produced per year [19]. Eggs have been a human food since ancient times. They are one of nature's nearly perfect protein foods and have other high-quality nutrients. Eggs are readily digested and can provide a significant portion of the nutrients required daily for growth and maintenance of body tissues. They are utilized in many ways both in the food industry and the home. The term "eggs", without a prefix, generally relates to chicken eggs and is so considered in this study [23]. Chicken eggs are one of the best sources of high-quality protein along with important vitamins and minerals. In both developed and developing countries an increased egg production and consumption could significantly improve nutritional needs of adults and children. Eggs are also an economical source of nutrients for a healthy diet and life, especially important for the mental development of growing children [19]. The purpose of this study is to describe the nutritional benefits of eggs in the human diet. Hence, in this study methodology/approach; the scientific literature was searched using Medline and key words relevant to eggs, egg nutrients and it is nutritional roles.

Keywords- Egg, nutritional benefits, health.

I. INTRODUCTION

Eggs, commonly available and low in cost or more affordable, represent a **"complete food"** required for wellbeing and are recognized by consumers as versatile and wholesome with a balance of essential nutrients to sustain both life and growth (10). After completion of 6th month of a baby, the supplementary food must start and continue up to 2 years beside breastfeeding, so egg is one of the most nutritional groups of food groups that can use to the supplementary food and the researches are commented in this issue; Ruxton, C. (2013) on his research highlighted that the mother's feeding is believed to influence infant health but later upon introduction of solid foods eggs are important source of protein and nutrients. In addition to their nutritional value, eggs have health promoting properties. In short, eggs are an inexpensive and low-calorie source of high-quality protein and other nutrients beneficial to human health [10]. Protein quality, a measure of the efficiency of use of the consumed protein by the human body, is determined by the presence and proportions of these amino acids of the protein. Food digestibility differs from others, so which one has the high digestibility is better according to the biological value. However, the true ileal digestibility of cooked and raw egg protein amounted to 90.9 ± 0.8 and 51.3 ± 9.8%, respectively and is the standard for evaluating the protein of other foods [14]. Amino acids are vital for production of enzymes, some hormones, hormone receptors, DNA components, and other functional components required for growth, tissue maintenance, and regulation of metabolic functions. • The polyunsaturated fatty acids, alpha-linolenic acid (n-3) and linoleic acid (n-6) are essential to human health. Eggs contain about 70 mg of omega-3 (n-3) fatty acids. Linoleic acids are metabolized to arachidonic acid; alpha-linolenic acid to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These essential long-chain

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fatty acids are components of phospholipids which contribute flexibility to cell walls and reduce plasma cholesterol levels [10]. The EPA and DHA also appear to reduce risks of cardiovascular, central nervous system, and mental health diseases, inflammation, and immune infections [9]. It was established that; egg consumption is not associated with the risk of CVD and cardiac mortality in the general population. However, egg consumption may be associated with an increased risk of type 2 diabetes, and diabetic patients with frequent egg consumption may be more likely to develop CVD comorbidity [20].

II. METHODOLOGY

This study is a review study; however, the scientific literature was searched using Medline and key words relevant to eggs & egg nutrients and it is nutritional roles was undertaken to examine nutritional and health benefits for consumers.

III. RESULTS AND DISCUSSION

Production & Consumption of Eggs

Globally, annual egg production has increased 2.3% from 2000 to 2010, although the regions varied [9]. USA was second, producing around 109 billion eggs in 2018. Based on FAO data and China's projected 2% percent compound annual growth rate, this country will produce 34.2 million tons of eggs by 2020 and 39 million tons by 2030 [3].

There were 1,627 trillion eggs produced globally in 2022, China is by far the world's largest egg producer, with 37 percent of global production in 2022. Asia provided more than 64 percent of the world's eggs in 2021. The United States has 28 chickens produced per person yearly. The Netherlands is the largest export country with 351,223 tonnes of eggs exported in 2021(Fig1) [15, 7].

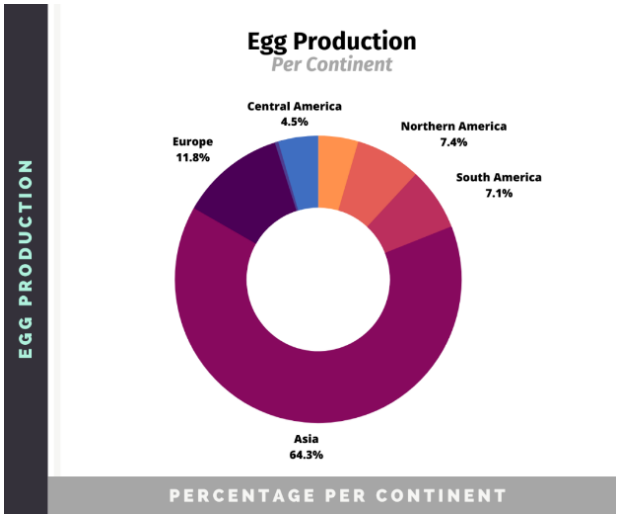

Fig (1): World egg production in 2022

The global production of eggs has shown a consistent upward trend over the years but has stabilized in the last years during the avian influenza outbreaks. Worldwide egg production peaked in 2020 at 1.65 trillion produced eggs [15]. **There were 1,627 trillion eggs produced globally in 2022**. This is a small decrease from the 1,633 trillion eggs produced in 2021 due to the global avian influenza pandemic. Most of the Asian egg production comes from China, followed by India and Indonesia. **China produced about 603 billion eggs in 2022**, an increase of 3% from the 586 billion eggs they produced in 2021(Fig2) [15, 8].

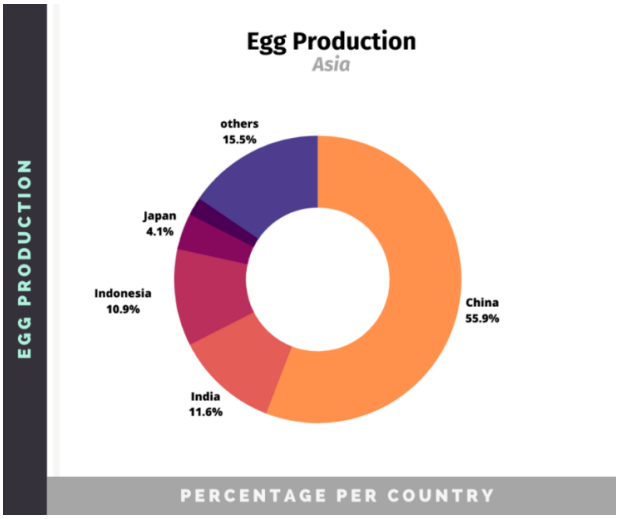

Fig (2): Asia egg production in 2022

Among the highest consumer countries of eggs in the world; China is the first consumers of eggs with annual egg consumption 34.55 million tons per year with average number of eggs consumed per person per year 400. The USA is the second highest consumers of egg with annual egg consumption of 6.35 million tons with a**verage number of eggs consumed per person per year 320. Likewise, India; Indonesia and Brazil with consumption of 6.24, 5.41 and 3.41 million tons are ranked third, fourth and fifth in terms of egg consumption in the world [7].** By 2050, the world's population is expected to reach 9 billion, with an enormous increase in protein needs. Global egg consumption has tripled in the past 40 years with consumer quality expectations increasing just as rapidly. Overall, world countries vary largely in egg consumption levels. With undernutrition remaining a significant problem in many parts of the developing world, eggs may be regarded as part of the solution to make up malnutrition [19].

IV. CHEMICAL COMPOSITION OF EGGS

Eggs are made up of a variety of chemical components, including water, protein, fatty acids,

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minerals, vitamins, and pigments. Accordingly, the egg is recognized as a valuable food with high nutrient value. Eggs comprise 75% water, after which they are mainly made up of protein and lipid (Li-Chan and Kim, 2008). Sugino et al. (1997) indicated that the chemical composition of eggs is affected by the feed as well as by other factors including the species and age of the hen. Hence, we have two types of chicken eggs such as conventional eggs and free-range eggs. Among these types of eggs, conventional housing constitutes about 90% of egg production, whereas free-run, organic, and free-range systems account for the other 10% . Overall, both types of eggs had similar physical properties, except for differences in the weight of the eggshells. For the chemical characterization, no difference in the protein quality of free-range eggs was observed when compared to conventionally farmed eggs, confirming that the variable diet of free-range hens did not impact the protein quality of their eggs. There was some variability with the amino acid composition [13].

Table (1): Chemical Composition of Eggs

Portion	Percentage (%)	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Whole Egg	100	75.2	12.6	10.5	1.0
Albumin	66	87.6	10.9	0.2	0.7
Yolk	34	51.1	16.0	30.6	1.7

*The proportion including shell: albumin=58%, yolk=30% and shell=12%

Eggs can make a significant contribution to a healthy diet. A medium-sized egg provides 78 kcal, yet contains 6.5 g protein. The fat content is 5.8 g, of which 2.3 g is monounsaturated fat (Table 2) [17].

Table (2): Nutritional composition of eggs (chicken egg, raw)

Nutrient	Nutrient Content per 100g	Per Medium egg (58g)
Energy (kcal)	151	78
Protein (g)	12.5	6.5
Carbohydrate (g)	Trace	Trace
Fat (g)	11.2	5.8
Cholesterol (mg)	391	225
Retinol (µg)	190	98
Vitamin D (µg)	1.6	0.9
Riboflavin (mg)	0.47	0.24
Folate (µg)	50	26
Vitamin B12 (µg)	2.5	1.3
Biotin (µg)	20	10
Phosphorus (mg)	200	104
Iron (mg)	1.9	0.99
Zinc (mg)	1.3	0.68
Iodine (µg)	53	28
Selenium (µg)	11	5.7
Choline (mg)	160	83.2

[Ruxton C.H.S., 2010].

Eggs provide the richest mix of essential amino acids (Layman and Rodriguez, 2009) which is important for children, adolescents and young adults since protein is required to sustain growth and build muscle [16]. Eggs are an excellent, nutrient-rich source of leucine, as well as other EAAs, these protein-related benefits may be important to active individuals who routinely consume eggs as part of a varied, balanced diet [11]. In addition, it should be mentioned that egg proteins are distributed equally between egg white and egg yolk, while lipids, vitamins, and minerals are essentially concentrated in egg yolk (Fig 3). Water constitutes the major part of egg (Fig 3) and it is noteworthy that the egg is devoid of fibers [21].

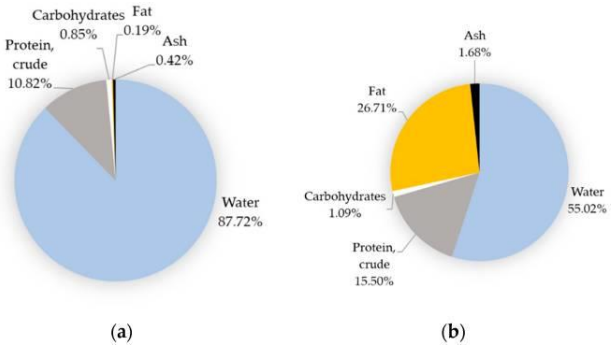

Fig (3): Basic composition of edible parts of the egg. (a) Egg white; (b) Egg yolk. Note that for (b), results refer to egg yolk/vitelline membrane complex. https://ciqual.anses.fr/.

V. NUTRITIONAL MESSAGES

- The quality of any single dietary protein source is based on its amino acid composition and the digestibility of that protein. In general, animal proteins, such as eggs, provide higher quality protein compared with vegetable-based proteins because of their higher levels of the EAA lysine, threonine, valine, isoleucine, leucine, methionine, phenylalanine, tryptophan, and histidine. The amino acid leucine, which works in concert with the insulin signaling pathway [11].
- The egg and, more precisely, the egg yolk, is a vitamin-rich food that contains all vitamins except vitamin C (ascorbic acid)[21].
- Eggs are a good source of vitamin A and contain the right type of components to maximize absorption of this vitamin into the body. Vitamin A is needed for healthy skin and eyes and for a strong immune system. Eggs are one of the few foods containing vitamin D. The vitamin D from eggs may be particularly well absorbed due to the presence of fat. The elderly, children, adolescents, dark skinned, obese, and veiled population sub-groups may

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particularly benefit from increased intakes of vitamin D rich foods, such as eggs. Eggs naturally provide a source of healthy fats that assist with increasing the absorption of vitamin E into the body. Eggs are a source of thiamin needed for conversion of carbohydrates into energy [5]. Eggs are a good source of riboflavin needed for conversion of food into energy. One serve of eggs provides almost a third of the recommended dietary intake for riboflavin. Eggs are a rich source of vitamin B5 needed for conversion of food into energy. One serve of eggs provides over 40% of the recommended dietary intake for vitamin B5. Eggs are a good source of folate that is highly bioavailable [5]. Eggs provide vitamin B12 along with folate, which can have advantages over folate fortified foods. Including eggs regularly in the diet of pregnant women can make a significant contribution to meeting daily folate requirements, therefore promoting a healthy pregnancy. Eggs are an excellent source of vitamin B12 needed for healthy red blood cells. One serves of eggs provides almost half of the recommended dietary intake for vitamin B12. Eggs can be a particularly valuable inclusion in the diets of the elderly as requirements for vitamin B12 increase with ageing [5].

- Egg is rich in phosphorus, calcium, potassium, and contains moderate amounts of sodium (142 mg per 100 g of whole egg). It also contains all essential trace elements including copper, iron, magnesium, manganese, selenium, and zinc, with egg yolk being the major contributor to iron and zinc supply [21].
- Eggs provide a valuable source of iron for groups at risk of iron deficiency including vegetarians, toddlers, pregnant women, and athletes. Eggs are an excellent source of selenium, a trace mineral required for many functions in the body. Eggs are an excellent source of iodine. Eggs are one of the few natural sources of iodine. Eggs are one of only a few food sources of choline. Choline is particularly useful in the diet of pregnant and lactating women. Eggs are therefore highly recommended at this time of life [5].
- Eggs contain the antioxidants lutein and zeaxanthin. Increased intakes of these antioxidants have been associated with eye health and may provide protection against age related eye disease.
- Eggs are a good source of omega 3. Eggs from unsuplemented laying hens may contain 93 mg ALA and 173 mg total omega-3 fatty acid (ALA, EPA, and DHA) [4].

VI. CONCLUSION

Eggs are a valuable source of a broad range of nutrients and are therefore a useful inclusion in a healthy eating pattern. Eggs are a rich source of protein and several essential nutrients, particularly vitamin D, vitamin B12, selenium and choline. Eggs have traditionally been used as the standard of comparison for measuring protein quality because of their essential amino acid (EAA) profile and high digestibility. Because eggs are an excellent, nutrient-rich source of leucine, as well as other EAAs, these protein-related benefits may be important to active individuals who routinely consume eggs as part of a varied, balanced diet.

REFERENCES

[1] Aima Zaheer, (2013). Countries with Highest Egg Consumption, https://finance.yahoo.com/news/top-20-countries-highest-egg-155805103.html
[2] China has ample supply of eggs despite global market shortage in 2023 caused by bird flu: agricultural experts.
https://www.globaltimes.cn/page/202304/1288877.shtml
[3] Conway A (2012). China Remains World's Top Egg Producer in 2012. WATTAgNet.
[4] Ehr I. J., M. E. Persia, and E. A. Bobeck, (2017). Comparative omega-3 fatty acid enrichment of egg yolks from first-cycle laying hens fed flaxseed oil or ground flaxseed, J. of Poult Sci. 96(6): pp. 1791–1799.
[5] Food & Nutrition Australia, Nutritional and Health Benefits of Eggs, February 2013
[6] Food and Agricultural Organization (2017). FAO Publications Catalogue 2017. United Nations: Food and Agricultural Organization.
[7] Food and Agriculture Organization of the United Nation, STATISTICAL YEARBOOK, 2022.
[8] Food and Agriculture Organization of the United Nation, STATISTICAL YEARBOOK, 2023.
[9] Fraeye, I., Bruneel, C., Lemahieu, C., Butse, J., Muylaert, K. and Foubert, I. (2012). Dietary Enrichment of Eggs with Omega-3 Fatty Acids: A Review. Food Research International, 48, pp. 961-969. http://dx.doi.org/10.1016/j.foodres.2012.03.01
[10] Khalid Zaheer, (2015). An Updated Review on Chicken Eggs: Production, Consumption, Management Aspects and Nutritional Benefits to Human Health, Food and Nutrition Sciences, 6, pp. 1208-1220, http://www.scirp.org/journal/fns
http://dx.doi.org/10.4236/fns.2015.613127
[11] Layman, D.K. and Rodriguez, N.R. (2009). Egg protein as a source of power, strength, and energy, Nutrition Today, Vol. 44 No. 1, pp. 1-6.
[12] Li-Chan, E.C.Y., Kim, H.-O., (2008). Structure and chemical composition of eggs. In: Mine, Y. (Ed.), Egg Bioscience and Biotechnology. Wiley-Interscience, Hoboken, NJ, pp. 1-8.
[13] Marcia M. English, (2021). The chemical composition of free-range and conventionally-farmed eggs available to Canadians in rural Nova Scotia, Peer J 9:e11357 DOI 10.7717.
[14] Pieter Evenepoel, Benny Geypens, Anja Luypaerts, Martin Hiele, Yvo Ghoos4 and Paul Rutgeerts, (1997). Digestibility of Cooked and Raw Egg Protein in Humans as Assessed by Stable Isotope Techniques, J. of American Society for Nutritional Sciences, https://pubmed.ncbi.nlm.nih.gov/9772141/

ISSN: 2583-4053
Volume-3 Issue-1 || February 2024 || PP. 172-176
https://doi.org/10.55544/jrasb.3.1.28

[15] Poultry Industry Statistics (2023): Meat & Egg Production, https://www.chickenfans.com/poultry-industry-statistics/#Global-Egg-Production
[16] Rodriguez, N.R. (2005). Optimal quantity and composition of protein for growing children, Journal of the American College of Nutrition, Vol. 24 No. 2, pp. 150S-4S.
[17] Ruxton C.H.S., (2010). The nutritional properties and health benefits of eggs. J.Emerald Nutrition and Food Science, Vol. 40 No. 3, pp. 263-279.
[18] Ruxton, C. (2013). Value of Eggs during Pregnancy and Early Childhood. Nursing Standard, 27, 41-50. http://dx.doi.org/10.7748/ns2013.02.27.24.41.e7343
[19] Shi Lei, (2021). The Role of Chicken Eggs in Human Nutrition, journal of food nutrition and metabolism |issn 2674-2411, www.sciencerepository.org
[20] Shin, J.Y., Xun, P., Nakamura, Y. and He, K. (2013). Egg Consumption in Relation to Risk of Cardiovascular Disease and Diabetes: A Systematic Review and Meta-Analysis. American Journal of Clinical Nutrition, 98, pp. 146-159. http://dx.doi.org/10.3945/ajcn.112.051318
[21] Sophie Réhault-Godbert,* Nicolas Guyot, and Yves Nys, (2019). The Golden Egg: Nutritional Value, Bioactivities, and Emerging Benefits for Human Health. MDPI Nutrients, 11(3): pp. 684.
[22] Sugino, H., Nitoda, T., Juneja, L.R., (1997). General chemical composition of hen eggs. In: Yamamoto, T., Juneja, L.R., Hatta, H., Kim, M. (Eds.), Hen Eggs: Their Basic and Applied Science. CRC Press, New York, pp. 13e24.
[23] Werner Grosch and Peter Schieberle, (2008). German Research Centre for Food Chemistry, https://www.researchgate.net/publication/227046039