The role of egg consumption in the first 1001 days of life: a narrative review

Abstract

Background/Aims **Eggs are a natural whole food providing an important array of nutrients that can be challenging to find in other everyday foods. Although evidence shows the benefits of egg consumption for mother and child, consumption rates remain low. The aim of this article was to review latest literature and guidance on egg consumption and examine barriers to consumption during the critical first 1001 days of life.**

Methods **This narrative review included an electronic search of PubMed, Google Scholar and Clinical Trials.Gov. Human studies published in English between 2019 and 2024 were screened for eligibility.**

Results **Overall, 14 key studies were included that were specific to egg intake/consumption during pregnancy, breastfeeding and/or infancy/early childhood. Six sets of relevant dietary guidelines were identified and reviewed.**

Conclusions **Current egg consumption is low, despite previous concerns about food safety and allergy having been overturned in official advice. Including eggs in the diet is an easy and cost-effective way to improve diversity and digestibility of nutrients when dietary requirements are higher. Their consumption has the potential to bridge nutrient gaps, help prevent allergy, augment breast milk composition and contribute to child development and growth.**

Keywords

Choline | Egg | Nutrient density | Pregnancy | Sustainability

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Eggs are an important basic 'whole food' (food that has been processed or refined as minimally as possible) because of their array of nutrients and bioactive compounds and high digestibility (Réhault-Godbert et al, 2019). It has been reported that ultra-processed foods can form as much as 17% of the total diet in pregnancy (Puig-Vallverdu et al, 2022). This, in turn, has been linked to less favourable maternal and infant outcomes, possibly as a result of reduced diet quality (Ben-Avraham et al, 2023). Nutrition is exceptionally important during pregnancy, when breastfeeding and in infancy as the dynamic physiological changes that take place are vast and generally not experienced in any other healthy life stage (Derbyshire, 2011; Shaw and Liu, 2023).

Nutritional profile

Pregnancy and breastfeeding are some of the most physiologically and nutritionally taxing life stages, where requirements for all nutrients rise and nutritional status can impact a mother's health and a child's development (Albracht-Schulte, 2023). Egg protein is a highly digestible and important provider of essential amino acids and is considered a 'complete protein' (Caffarelli et al, 2022; Puglisi and Fernandez, 2022). Eggs are one of the few foods that deliver >20% of the daily value of protein per 100g or per 100kcal (Drewnowski, 2021). Egg yolk provides vitamins A, B1, B2, B5, B6, B9, B12 and D, and egg white provides vitamins B1, B2, B3, B6, B9, and B12 (Réhault-Godbert et al, 2019). Eggs naturally contain vitamin B12 (cobalamin), which is generally not present in plant foods (Obeid et al, 2019). Eggs also provide important minerals, such as calcium, phosphorous, potassium, iron, zinc, selenium, magnesium and manganese (Réhault-Godbert et al, 2019).

The consumption of eggs (two per day for pregnancy and lactation, one per day for infants aged 1–3 years) helps to make a useful contribution towards dietary recommendations for many nutrients, including protein, vitamin D, vitamin B12, choline, biotin, iron, zinc, iodine, and selenium (*Table 1*). Choline is principally concentrated in egg yolk (820mg/100g) compared

with egg white (1.1mg/100g) (U. S. Department of Agriculture, 2023). Choline is traditionally known for its roles in brain development and neurocognition (Derbyshire and Obeid, 2020). A recent meta-analysis reported that lower maternal choline intakes were associated with a higher odds ratio for neural tube defects, indicating that higher intakes are likely to be associated with improved child development (Obeid et al, 2022). As shown in *Table 2*, there are several UK and European authorised health claims that can be applied to the pregnancy and childhood life stages. In particular, eggs are a source of folate, which can contribute to maternal tissue growth during pregnancy (Department of Health and Social Care, 2022; European Commission, 2024).

Nutrient bioavailability

Research has shown that eggs are a bioavailable source of essential amino acids and the role of egg protein in health deserves attention (Puglisi and Fernandez, 2022; Connolly et al, 2023). Eggs are also one of the few dietary

Table 1. Nutritional composition of UK hens' eggs and contribution to daily dietary intake guidelines for pregnancy, breastfeeding and infants aged 1–3 years

Nutrient	Per egg*	Pregnancy recommendation (% provided by eggs†)	Breastfeeding recommendation (% provided by eggs†)	Infancy recommendation (% provided by eggs‡)
Energy kcal	83	2140 (8)	2390 (1m PP) (7)	1198 (7)
Protein g	8.1	51 (31)	56 (0–4m PP) (29)	14.5 (56)
DHA (22:6n-3)§	-	+100–200mg, preformed††	+100–200mg, preformed††	-
Vitamin A µg	70	700 (20)	950 (0–4m PP) (15)	400 (18)
Vitamin D µg	1.9	10 (38)	10 (38)	10†† (19)
Vitamin E mg	0.9	>3	>3	-
Vitamin B1 (thiamine) mg	0.05	0.9 (11)	1.0 (0–4m PP) (10)	0.5 (10)
Vitamin B2 (riboflavin) mg	0.3	1.4 (43)	1.6 (0–4m PP) (38)	0.6 (50)
Vitamin B3 (niacin) mg	0.06	13 (1)	15 (0–4m PP) (1)	8 (0.8)
Vitamin B5 (pantothenic acid) mg	0.8	3–7	3–7	1–7
Vitamin B6 (pyridoxine) mg	0.06	1.2 (10)	1.2 (10)	0.7 (9)
Vitamin B9 (folate) µg	17	300 (11)	260 (0–4m PP) (13)	70 (24)
Vitamin B12 (cobalamin) µg	1.2	1.5 (160)	2.0 (0–4m PP) (120)	0.5 (240)
Choline mg	194‖	480¶ (81)	520¶ (75)	140¶ (139)
Biotin µg	9.9	40** (50)	45** (44)	20** (50)
Calcium mg	32	700 (9)	1250 (0–4m PP) (5)	350 (9)
Phosphorous mg	119	550 (43)	990 (0–4m PP) (24)	270 (44)
Potassium mg	82	3500 (5)	3500 (5)	800 (10)
Magnesium mg	8.1	270 (6)	320 (0–4m PP) (5)	85 (10)
Manganese mg	0.02	1.4 (3)	1.4 (3)	-
Iron mg	1.1	14.8 (15)	14.8 (15)	6.9 (16)
Zinc mg	0.8	7.0 (23)	13.0 (0–4m PP) (12)	5.0 (16)
Copper mg	0.04	1.2 (7)	1.5 (0–4m PP) (5)	0.4 (10)
Iodine µg	30	140 (43)	140 (43)	70 (43)
Selenium µg	16	60 (53)	75 (0–4m PP) (43)	15 (107)

Note: recommendations taken from Department of Health and Social Care (1991)
*Medium whole boiled chicken egg 58g (Public Health England, 2021), †per serving 2 eggs, ‡per serving 1 egg, §Lutter et al (2018), ‖U. S. Department of Agriculture (2023), ¶European Food Safety Authority (2016), **European Food Safety Authority (2014), ††Scientific Advisory Committee on Nutrition (2023)

Table 2. Nutrition and health claims specific to pregnancy and childhood for hens' eggs in the UK and Europe

Nutrient	Cut offs for 'source of' and 'high in' claims	Content in 100g of egg (edible portion)	Permitted nutrition claim for eggs	Authorised health claim that can apply
Folate	Source of 15% of recommended daily allowance, high in 30% of recommended daily allowance	23.5%	Source of folate	Contributes to maternal tissue growth during pregnancy
Vitamin D	Source of 15% of recommended daily allowance, high in 30% of recommended daily allowance	64.0%	High in vitamin D	Contributes to normal function of immune system and needed for normal growth and bone development in children
Protein	Source of 12% of energy provided by protein, high in 20% of energy provided by protein	38.5% of energy provided by protein	High in protein	Needed for normal growth and bone development in children
Phosphorous	Source of 15% of recommended daily allowance, high in 30% of recommended daily allowance	25.5%	Source of phosphorus	Needed for normal growth and bone development in children
Iodine	Source of 15% of recommended daily allowance, high in 30% of recommended daily allowance	33.3%	High in iodine	Contributes to normal growth of children
Choline	Health claim allowed if 82.5mg/100g food	335	None authorised	Maintenance of liver function

Source: Department of Health and Social Care (2022), Myers and Ruxton (2023), European Commission (2024)

food sources that can provide vitamin D (Benedik, 2022). A single medium sized egg (60g) has been found to provide 40–86µg of folate, predominantly the 5-methyltetrahydrofolate form, which has greater stability under boiling (Czarnowska-Kujawska et al, 2021). This is approximately 13–29% of the recommended daily intake for pregnancy (*Table 1*).

Choline is present in the diet in forms that may be water-soluble (free choline, glycerophosphocholine and phosphocholine) and lipid-soluble (phosphatidylcholine and sphingomyelin), with most choline in infancy (from human milk) tending to be in the water-soluble form, transitioning to fat-soluble forms later on through life (Wiedeman et al, 2018). Natural choline (from egg yolk phospholipids) has been found to be absorbed more efficiently than choline bitartrate (Smolders et al, 2019). Eggs are also an important provider of fatty acids, with docosahexaenoic acid in particular thought to be critical for brain development and visual acuity in early life (Lauritzen et al, 2016). Increasingly, this nutrient is thought to work in synergy with choline (Mun et al, 2019), also provided by eggs.

Egg consumption in the first 1001 days

From a historical perspective, there can be confusion around egg consumption, as previous advice was to avoid eggs in pregnancy and weaning because of egg allergy and food safety concerns. However, evidence and advice has changed and evolved over the last decade (Réhault-Godbert et al, 2019; Sarno et al, 2021). Misunderstandings and misconceptions could impact egg consumption at key life stages when nutrients provided from eggs can be important. For example, a systematic review of women's dietary patterns before and during pregnancy reported reductions in egg consumption, which could be attributed to such concerns or confusions (Hillier and Olander, 2017). Additionally, cultural norms, practices, beliefs and misinformation may act as barriers to egg consumption during these crucial life stages (Schnefke et al, 2019).

There has been growing interest in the role of optimised nutrition across the first 1001 days of life, defined as the period of time from conception to 2 years of age (Beluska-Turkan et al, 2019; HM Government, 2021). Given this, the present review's aim was to explore latest evidence related to egg consumption across the first 1001 days of life and put any confusions in context.

Methods

For this narrative review, PubMed was searched to identify key articles published between 2019 and 2024 investigating egg consumption during pregnancy, breastfeeding and/or infancy. The following search terms were used: 'Egg Intake' or 'Egg Consumption' combined with '1000 days' or '1001 days', and then the MeSH terms 'Pregnancy', 'Lactation', 'Breastfeeding', 'Breast milk', 'Infant' and 'Child, Preschool'. A further search was conducted in Google Scholar and ClinicalTrials.gov to identify any additional

publications, and reference lists were also searched. All studies were human studies undertaken in industrialised nations written in English. Multi-interventions and publications that contained errors or amendments were omitted, as they may have skewed study findings and made cause-and-effect inter-relationships harder to identify (Wu et al, 2020; Zhang et al, 2022). A total of 14 studies were included in the review.

Selected websites and reports including Allergy UK, the European Food Safety Authority, Food Standards Agency (FSA), NHS, Scientific Advisory Committee on Nutrition (SACN) and NHS and Allergy UK were reviewed for evidence related to eggs and intake recommendations across these life stages.

Results

Pregnancy

Four of the identified studies focused on pregnancy and health, fetal or nutrient outcomes (*Table 3*). Two focused on nutrition outcomes, the Canadian Alberta Pregnancy Outcomes and Nutrition study found that only 23% of mothers (n=2189) met adequate intake recommendations for choline and only 10% met postpartum recommendations, with egg consumption increasing the likelihood of meeting these recommendations (Letourneau et al, 2022). In Australia, similar findings were observed; median pregnancy choline intakes were 362mg/day (lower than the EFSA (2016) recommendations of 480mg/day), and eggs were the most significant contributor of choline intake, providing approximately 17% of daily choline (Probst et al, 2022).

Christifano et al (2023) found links between maternal egg intake and nutrients contained in eggs (choline, lutein, zeaxanthin and docosahexaenoic acid) and markers of fetal autonomic and brain development. In the UK, the Cambridge Baby Growth Study analysed food intake frequencies in 865 pregnant women and found that the frequency of egg consumption appeared to be protective against gestational diabetes mellitus and reductions in insulin secretion (Petry et al, 2019).

Breastfeeding, infancy and early childhood

Ten of the studies investigated eggs in relation to breast milk quality, allergy, growth or nutritional outcomes. With regard to breast milk composition, Huang and Hu (2020) monitored 220 breastfeeding mothers, finding that a dietary pattern including eggs, red meat and cereals was associated with higher total dry matter, protein and energy content in breast milk compared with dietary patterns involving fresh vegetable/legume, fungi/algae/legume and soy milk dietary patterns.

In relation to allergy risk, a randomised controlled trial of 380 breastfed infants whose parents (at least one of two parents) had allergic disease found that the maternal consumption of one egg per day during the first 5 days after birth did not impact infant egg allergy development nor sensitisation to egg white when compared to mothers who completely abstained from consuming eggs (Nagakura et al, 2023). Other research analysed data from 1252 children in the USA Infant Feeding Practices Study II and found that the risk of maternal-reported egg allergy at 6 years old significantly declined with infant egg consumption frequency at 12 months of age, indicating a potentially protective role (Wen et al, 2023). In instances where single food allergies exist (such as egg allergy), Poredos et al (2023) showed that these tend not to influence children's growth and catch-up growth tends to be achieved.

In the UK, a secondary data analysis of three datasets focusing on weaning habits in infants aged 6–12 months found that just over half (54%) of infants had ever been offered eggs and average egg intake was 1–2 times per week, increasing with age (Rowan and Brown, 2023). With respect to growth, a meta-analysis of data from 3575 children aged 6 months to 6 years found that those eating eggs (given alone or with another food/supplement) had improved height, length and weight, indicating that eggs are a viable nutritious option for reinforcing children's growth (Larson et al, 2024). A Cochrane review focusing on animal-source food in relation to growth and development yielded inconclusive results, because of imbalances between control and intervention groups (Eaton et al, 2019).

Three studies focused on the nutrient density of children's (<2 years old) diets, finding that eating eggs was linked to higher daily energy, protein, total fat, polyunsaturated and monounsaturated fat, α-linolenic acid, choline, docosahexaenoic acid, lutein + zeaxanthin, vitamin D, potassium, phosphorus and selenium intakes (Papanikolaou and Fulgoni, 2019). Another modelling publication by the same research team concluded that eggs represent a cost-efficient food for children, providing around 2.7% of protein in daily diet, 3.8% of vitamin A, 5% of vitamin D and about 12% of choline (Papanikolaou and Fulgoni, 2020), indicating that these are an economically viable food choice. Spanish scientists evaluated food and nutrient intakes across the first 2 years of life (infants aged 18 and 24 months) (Gómez-Martin et al, 2021). It was found that egg intakes were lower than recommended at both time periods; 2 and 2.5 servings per week (at 18 and 24 months respectively) were consumed compared to the recommendation in Spain of 3.5 servings per week (Gómez-Martin et al, 2021).

Current advice and recommendations

A summary of recommendations related to eggs is shown in *Table 4*. In general, egg allergies are triggered by the protein part of an egg found in the egg yolk and

Table 3. Key publications looking at egg consumption, and maternal and infant health (published 2019–2024)

Author (year) location	Life stage	Type of study	Methods	Study outcome	Conclusion
Christifano et al (2023) USA	Pregnancy	Observational	Food frequency questionnaires assessed egg and nutrient intake during pregnancy (*n*=202). Fetal neurodevelopment measured using fetal biomagnetometry at 32 and 36 weeks' gestation	Fetal neurodevelopment	Eggs and nutrients contained in eggs showed synergistic associations with fetal neurodevelopment
Probst et al (2022) Australia	Pregnancy	Randomised controlled trial	Food frequency questionnaire completed (*n*=103) at 12–16 weeks' and 36 weeks' gestation to assess dietary intake over previous month	Choline intakes	Eggs most significant contributor to choline intakes (17%). Few women met adequate intakes for choline
Petry et al (2019) UK	Pregnancy	Observational	Food intake frequencies (*n*=865) from qualitative short questionnaire taking part in Cambridge Baby Growth Study	Baby growth	Frequency of egg consumption appeared protective against gestational diabetes mellitus and reductions in insulin secretion
Letourneau et al (2022) Canada	Pregnancy and childhood	Observational	Mothers and children (*n*=2189) from Alberta, Canada taking part from pregnancy to when children were 3 years old	Pregnancy and child outcomes	Only 23% of mothers met adequate intake choline recommendations. Eating eggs during pregnancy increased likelihood of meeting choline adequate intake recommendations
Nagakura et al (2023) Japan	Maternal diet after birth/infancy	Randomised controlled trial	Newborns (*n*=380) randomised to maternal egg consumption (1 whole egg/day during neonate's first 5 days) and elimination groups	Egg allergy at 12 months	At 12 months, groups did not differ significantly in egg allergy. Egg allergy therefore unaffected by maternal egg consumption
Huang and Hu (2020) China	Lactation	Observational	Lactating women (*n*=220) completed 24-hour recall, breast milk samples collected	Breast milk composition	Dietary profile with higher egg intake (and red meat and cereals) associated with higher protein, total dry matter and energy contents in breast milk
Rowan and Brown (2023) UK	Infancy	Secondary data analysis	7-day food frequency questionnaire (*n*=297), 24-hour recall (*n*=180) and 3-day weighed food diary (*n*=71). Egg introduction, frequency of consumption and intake measured in infants aged 6–8, 9–10 and 11–12 months	Egg intake	Just 54% of infants aged 6–8 months had ever been offered eggs. Baby-led infants consumed eggs twice as frequently as spoon-fed infants
Wen et al (2023) USA	Infancy/ childhood	Observational	Children (*n*=1252) from Infant Feeding Practices Study II (2005–2012). Mothers reported frequency of infant egg consumption at 2, 3, 4, 5, 6, 7, 9, 10 and 12 months and status of child's egg allergy at 6-year follow-up	Egg allergy	Risk of maternal-reported egg allergy at 6 years significantly declined with infant egg consumption (at 12 months: 2.05% risk for not eating eggs, 0.41% for eating eggs <2 times per week, 0.21% for ≥2 times per week)

Table 3. Key publications (continued)

Author (year) location	Life stage	Type of study	Methods	Study outcome	Conclusion
Eaton et al (2019) USA	Infancy/ childhood	Cochrane review of randomised and quasi-randomised controlled trials	Studies (*n*=6) from 3036 children aged 5–50 months	Growth and development	Results were inconclusive because of limited quality of evidence
Gómez-Martin et al (2021)	0–2 years	Prospective and multicentre study	Analysing administered questionnaires about general characteristics and food frequency consumption (*n*=426 children aged 18 months, *n*=336 aged 24 months)	Compliance with nutritional targets	Observed intakes of eggs lower than recommended in children aged 18 and 24 months. Whole sample fell below vitamin D requirements
Larson et al (2024) USA	Childhood	Meta-analysis	Studies (*n*=7) reporting on nine interventions (*n*=3575 participants)	Growth in children	Those in egg intervention groups experienced significantly greater increases in height/length ($P<0.01$) and weight ($P=0.03$) compared to control groups
Poredos et al (2023) Slovenia	Childhood	Retrospective cohort study with longitudinal follow-up (mean period: 4.85 years)	Boys (*n*=61) and girls (*n*=33) (6.9 years) had a single food allergy including 34 with egg allergies. Control group: 36 children	Nutritional and growth outcomes	Children with egg allergies had normal growth and achieved catch-up growth, indicating that allergies do not compromise growth if children are supported
Papanikolaou and Fulgoni (2019) USA	Childhood	Observational	National Health and Nutrition Examination Survey 2001–2012 data for children and adolescents aged 2–18 years (*n*=3299 egg consumers; *n*=17 030 non-consumers)	Daily nutrient intakes	Children and teens eating eggs had elevated daily intake of protein, polyunsaturated, monounsaturated and total fat, α-linolenic acid, docosahexaenoic acid, choline, lutein + zeaxanthin, vitamin D, potassium, phosphorus and selenium
Papanikolaou and Fulgoni (2020) USA	Childhood	Observational	National Health and Nutrition Examination Survey 2013–2016 data (egg consumers: 2–18 years old, *n*=956; ≥19 years-old, *n*=2424)	Daily nutrient intakes	Eggs ranked most cost-efficient food for protein, choline and vitamin A, second for vitamin E, third for vitamin D

white, which can trigger an immune response (Dona and Suphioglu, 2020). Some confusion may exist about egg consumption during pregnancy and infancy because it was previously believed that raw and lightly cooked forms of egg could elevate salmonella food poisoning risk (Allergy UK, 2024). In 2017, the Food Standards Agency (2017) updated the advice, explaining that eggs produced under the 'British Lion Code of Practice' could be safely eaten in raw or lightly cooked forms by pregnant women, babies and infants. The NHS (2023) currently advises that British Lion eggs are safe for pregnant women to eat in raw or partially cooked form, eg soft-boiled eggs, as they come from flocks that have been vaccinated against salmonella.

Regarding breastfeeding, Allergy UK recognise that traces of egg protein can pass into mother's milk and if the infant has any gut or skin symptoms, such as eczema, they could benefit from the mother eliminating eggs from her diet. If there are no improvements in the infant's symptoms after 2 weeks, eggs can then be reintroduced to the mother's diet (Allergy UK, 2024). In relation to weaning, the SACN (2018) advise that foods containing hen's eggs should be introduced from around 6 months of age and need not be differentiated from other solid

Table 4. Latest egg consumption guidance

Organisation	Advice
General advice (Allergy UK, 2024)	Most children with an egg allergy will outgrow it by the time they go to school but may persist into later childhood for some, or in rare cases, adulthood. Reactions to egg are usually triggered by the protein part of the egg (mainly in the egg white)
Pregnancy (NHS, 2023)	Eggs produced under the British Lion Code of Practice are safe for pregnant women to eat raw or partially cooked, as they come from flocks that have been vaccinated against salmonella.
Breastfeeding (Allergy UK, 2024)	Small amounts of egg protein may be passed through mother's milk during breastfeeding. If the infant has no symptoms the mother can continue eating egg. If the infant has gut or skin symptoms such as eczema, they may benefit from the mother trialling excluding egg from her diet. If there is no improvement in symptoms after 2 weeks, eggs can be reintroduced back into the mother's diet.
Pregnancy, infancy, childhood (Food Standards Agency, 2017)	Pregnant women, infants and children can safely eat raw or lightly cooked eggs that are produced under the British Lion Code of Practice.
European Food Safety Authority advice: infancy (Castenmiller et al, 2019)	Suggests hen's egg introduction between 4 and 6 months
Infancy, ≥6 months (Scientific Advisory Committee on Nutrition, 2018)	Advice on complementary feeding should state that foods containing hen's egg can be introduced from around 6 months and need not be differentiated from other solid foods. The deliberate exclusion of hen's egg beyond 6–12 months of age may increase the risk of allergy to the same foods.

foods. They report that the deliberate exclusion of hen's egg beyond 6–12 months may increase the risk of allergy to the same foods (SACN, 2018). EFSA advise hen's egg introduction between 4 and 6 months (Castenmiller et al, 2019).

Discussion

Mothers may feel confused about whether eggs are safe to eat during the first 1001 days of life; they may be given out-of-date advice from older generations or current advice may be misunderstood. The evidence indicates that eggs are an important food for pregnancy, healthy birth outcomes and child nutrition (Lutter et al, 2018), and that avoidance in pregnancy or weaning can increase the risk of egg allergy in the infant. As identified in the present review, eggs are an important and affordable 'complete' protein food (Caffarelli et al, 2022). They provide an array of nutrients, including vitamins A, B1, B2, B3, B5, B6, B9, B12 and D, choline, biotin, calcium, phosphorous, potassium, magnesium, manganese, iron, zinc, iodine, selenium and bioactive components such as lutein and zeaxanthin (Réhault-Godbert et al, 2019; Probst et al, 2022; Christifano et al, 2023). The consumption of eggs may therefore help to fill any gaps between daily nutrient intakes and recommendations across these life stages.

Both the Canadian APrON study and Australian research demonstrated that eggs are an important provider of choline and their consumption can help to close gaps between daily intake and advised intake recommendations that would otherwise not be achieved from dietary sources alone (Letourneau et al, 2022; Probst et al, 2022). It has been recognised that choline in the maternal diet is needed to maintain normal liver function in the fetus and breastfed infants, and depletion could contribute to fatty liver (Obeid et al, 2024). It is also possible that the choline and docosahexaenoic acid present in eggs work in synergy (Mun et al, 2019; Christifano et al, 2023). Six key nutrients (choline, docosahexaenoic acid, folate, vitamin D, iodine and iron) have been identified as important in the maternal diet for the child's brain development (Cheatham, 2019), with most of these nutrients being found in eggs.

Unfortunately, during these important life stages modern diets may not be at their prime, through a combination of ultra-processed food consumption, avoidance of meat and the cost-of-living crisis. The consumption of ultra-processed foods in pregnancy has been associated with reduced cognitive domains (verbal ability) in early childhood, indicating that the nutritional density of diets could be being diluted (Puig-Vallverdu et al, 2022). Similarly, researchers at the University of Southampton identified that pregnant women eating modern diets were missing key nutrients (90% were lacking key vitamins necessary for healthy pregnancies and the wellbeing of unborn infants) and the authors predicted that this could further exacerbate with a move to plant-based foods (Godfrey et al, 2023). Eggs are an increasingly important food for pregnant women who may not be eating as much meat or are vegetarian, both for their nutritional content and affordability and because they have a lower environmental impact than other animal proteins. Eggs are a natural food containing all the nutritional requirements needed to support a

developing embryo, making them an ideal food during pregnancy and early life (Réhault-Godbert et al, 2019). They are regarded as an 'encapsulated' source of protein and provide a ra nge of highly bioavailable nutrients at an affordable price (Réhault-Godbert et al, 2019).

Compared to a decade ago, two new sets of guidance now exist: the updated guidance on eating runny eggs (Food Standards Agency, 2017) and the feeding in the first year of life report (SACN, 2018). Both sets of guidance confirm the suitability of eggs, even when raw or only lightly cooked, for feeding to young babies and pregnant women (Gray, 2019). Nevertheless amongst UK infants aged 6 to 12 months just over half (54%) of infants appear to have been offered eggs (Rowan and Brown, 2023). Among infants aged 8-10 months in the UK, data show that a quarter of infants were given eggs 1–6 times a week and 75% were given eggs less than once a week or never (SACN, 2018). This demonstrates that despite the clear advice on feeding eggs to babies when weaning starts, many parents do not do so. More randomised controlled trials using egg interventions are needed to continue advancing research across these important life stages.

Given increased interest in sustainability, it is important to be aware that eggs have one of the lowest environmental impacts and use less carbon, land and water than other animal protein, such as beef (Myers and Ruxton, 2023). The British Dietetic Association reports that per 100g of protein produced, eggs use less land (5.7 m^2 versus 164 m^2 respectively) and produce lower greenhouse gas emissions than beef (4.2kg versus 50kg of CO_2, respectively) (One Blue Dot, 2024). Taken together, the nutritional, health and environmental explanations behind why eggs are an important food across these life stages needs to be disseminated in health sectors so that this information is understood and can be used by parents.

Conclusions

Given the change in guidance regarding egg safety and allergy, and the growing evidence base demonstrating the nutritional benefits of egg consumption across pregnancy, breastfeeding and childhood, it is important that healthcare professionals are aware of this information. The evidence and advice can be put into context and conveyed to parents and carers, as many restrict consumption of eggs. The evidence reviewed indicates that eggs represent an important and bioavailable source of protein and contain a number of key nutrients, including vitamins D, folate and choline, for the first 1001 days of life. Given the current economic climate, eggs provide an affordable, natural, easy, bioavailable and environmentally friendly means of nutrient delivery. **BJM**

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Key points

- Previous advice related to egg allergy and food safety concerns may have caused confusion among healthcare professionals, but evidence and guidance has now evolved and changed.
- Consuming eggs in pregnancy and early in weaning can help protect against allergy, and eggs are a cost-effective, nutrient-dense whole food that provide an array of nutrients that are readily absorbed and metabolised.
- Pregnant women's diets may be insufficient in key nutrients because of ultra-processed food consumption and meat avoidance, with the cost-of-living crisis likely to exacerbate this.
- Eggs are a natural (non-processed) food with a low environmental impact. For vegetarians, the integration of eggs could be a useful mode of delivering additional nutrients into diets.
- Some nutrients found in eggs may have important health and developmental roles during pregnancy; for example, eggs are a source of folate, which can contribute to maternal tissue growth during pregnancy.
- Eggs also contain important brain nutrients, such as choline (a precursor to the neurotransmitter acetylcholine), which is regarded as important for fetal brain development, and docosahexaenoic acid, which may operate in synergy with choline to facilitate development in early life.
- Despite clear official advice about eggs being safe and recommended early in weaning to help protect infants against egg allergy, they are still not widely nor confidently consumed during pregnancy, when breastfeeding or fed to babies when weaning starts.
- The consumption of eggs in the first 1001 days has the potential to bridge nutrient gaps, augment breast milk composition, help protect against allergy and contribute to child development and growth.

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CPD reflective questions

- Are you aware of the nutrients provided in eggs and their potential to improve dietary profiles of the mother and child during the first 1001 days?
- Do you understand how egg consumption could help to improve child development and growth? Do you think eggs could be a useful food for vegetarians to consider?
- If a mother-to-be or new mother was to ask about egg safety during these life-stages, what would you advise? Have your views changed after reading this article?
- Do you feel informed about weaning advice in relation to the introduction of eggs and egg allergy risk?