Breast milk is the initial natural food for infants, but already during the second half year complementary feeding is essential. The World Health Organization recommends that infants should be exclusively breastfed for the first 6 months of life, and thereafter receive nutritionally adequate and safe complementary feeding while breastfeeding continues for up to 2 years or beyond [1]. Evidence-based knowledge on how best to feed infants is growing, although many unknowns remain.

Celiac disease (CD), also called gluten intolerance, is an autoimmune-like disease that classically presents during the first years of life with diarrhea and failure to thrive, but atypical presentations at any age are increasingly recognized [2, 3]. CD is effectively treated with lifelong exclusion of foods containing any gluten-bearing cereals (wheat, rye, or barley). It is worth noting that CD cases have been reported from all continents, with rising incidence in many places.

A Paradigm Shift Concerning Complementary Feeding

Many were surprised when Sweden, in the mid-1980s, was struck by an epidemic of CD among children under 2 years of age (fig. 1). This followed on a nationally launched recommendation to delay the introduction of all gluten-containing foods to infants until 6 months of age, in line with changes at that time in many European countries [3].

This was the starting point for extensive CD epidemiological research with findings that initially were met by skepticism [2], but
Fig. 1. Annual incidence rates of CD in children from 1973 to 2003. From Olsson et al. [3] with permission.

Fig. 2. An epidemiological approach to CD research. Adapted from Ivarsson et al. [2] with permission.
later accepted and often referred to as a benchmark. Most importantly, we showed that CD risk is lower if breastfeeding is still ongoing when gluten-containing foods are introduced, and if gluten is given in small to medium amounts (as compared to large amounts) during the introductory period. We also showed that further prolonged breastfeeding reduced CD risks even more. Subsequent studies suggested the optimal age for introducing gluten as being 4–6 months [4]. By the mid-1990s, Swedish national infant feeding recommendations changed in line with these findings, and at that time the CD epidemic also abated.

Thus, the message from CD research regarding introduction of gluten is that ‘earlier is better’, as long as the mother is still breastfeeding, possibly providing an ‘immunological umbrella’ and/or a different age interval gives a ‘window of opportunity’ for developing oral tolerance. Recently, the same shift in thinking has been reflected in publications on atopic disease risk [5].

**Current Epidemiological Research**

It is evident that epidemiological research has contributed to an improved understanding of the role infant feeding habits have on the development of CD and atopic disease. In the past, epidemiology was mainly concerned with communicable disease epidemics, but nowadays contributes to an increased understanding of many phenomena related to health in populations. A commonly used definition is ‘the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems’ [2].

The emphasis is on taking advantage of the often underutilized potential of observational studies, but experimental study designs for complex community interventions are also being developed in parallel. Importantly, it is becoming increasingly evident that the highly valued experimental randomized control trial is not a sufficient method for many research questions related to human health. In approaching a certain phenomenon, a stepwise use of different epidemiological research designs is often advisable, moving from observational descriptive and analytical studies towards experimental designs when feasible. This is illustrated by the epidemiological approach to CD research from the early 1980s until now [2] (fig. 2).

**Conclusions**

During the last decade, epidemiological research has driven a paradigm shift with respect to most favorable age to introduce
complementary feeding, that simplified implies a shift from later to earlier introduction, which has been taken into account in recent recommendation changes. Complementary feeding, including all foods, should not be initiated for any infant before 4 months of age and no later than around 6 months, also for those with elevated disease risk (e.g. for CD or atopic diseases). This will for some infants be in conflict with recent World Health Organization recommendations on exclusive breastfeeding for 6 months. Epidemiology has evolved over time and could, if increasingly used, contribute even more to innovations in pediatric nutrition, and other phenomena related to population health.

References