by spontaneous binding of beta-lactoglobulin with DHA in the presence of pectin to form a nanocomplex, which can be potentially used for the enrichment of clear, acidic non-fat drinks. Due to the small size of the nanocomplex, no turbidity was observed and the mean size of the nanoparticle was 100 nm. While this method has been reported to have protective effects on DHA from oxidation, further tests are required to evaluate the heat stability and long term storage.[74] Folic acid, a form of vitamin B is essential for the proper development of the human body and is required for the synthesis and repair of DNA. Folic acid was encapsulated in a hydrocolloid composed of whey protein concentrate or a commercially resistant starch. The encapsulation was achieved by two different methods—electrospraying and nanospray drying methods—and the physicochemical properties of the nanoencapsulates obtained were analyzed. Electrospraying resulted in smaller particle size, and encapsulation efficiency and folic acid stability was better when whey protein concentrate was used for the nanocolloid formulation.[75]

Vitamin E is a sensitive, lipophilic vitamin that is important in maintaining health and preventing chronic diseases. The effect of glycerol on vitamin E acetate-loaded nanoemulsions synthesized by spontaneous emulsification of medium chain triglyceride oil and Tween 80 was reported.[76] The analysis of the formation, stability and properties of the nanoemulsions showed that water-soluble glycerol acts as a co-solvent and showed an appreciable effect on the particle size of the nanoemulsion, which also resulted in decreased turbidity of the nanoemulsion. Long-term stability was dependent on glycerol concentration and storage temperature. These observations are important for the development of vitamin E-enriched food and pharmaceutical applications.[76] The droplet size could be further modulated and smaller particles could be achieved by increasing the mixing temperature and stirring speed during the addition of organic phase to aqueous phase.[77] The same group of researchers reported the use of two polar co-solvents—propylene glycol and ethanol—in the development of vitamin E acetate-loaded nanoemulsions and analyzed the effect of the co-solvents on the formation, stability and physical properties of the nanoemulsion.[78] Vitamin D is a fat-soluble micronutrient essential for intestinal absorption of minerals and includes calciferol (D2) and cholecalciferol (D3). Recently, the effects of carrier oil used for nanoencapsulating vitamin D3 within an oil-in-water emulsion formulated using a natural surfactant quillaja saponin were tested. Carrier oil with distinct reactivity to lipase digestion and molecular properties such as medium chain triglycerides, long chain triglycerides like corn oil and fish oil, and indigestible oils like orange oil and mineral oil were selected for the study. The bioaccessibility of the encapsulated vitamin was studied in a simulated gastrointestinal tract, and long chain triglycerides (corn oil and fish oil) resulted in highest levels of bioaccessibility, while the rate of free fatty acid release was highest for medium chain triglycerides.[79] In 2012, a similar study was conducted to analyze the bioaccessibility of β-carotene nanoemulsions formulated using different carrier oils. The bioaccessibility of long chain triglycerides and medium chain triglycerides showed similar values,