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Invited Commentary

Medium-chain fatty acid nanoliposomes suppress body fat accumulation in mice

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Research and development on food applications of nanoscale science has been growing worldwide[1] and, although nanostructures are not a new phenomenon in our diet, it is now possible to characterise them much better than before due to marked technological advances, for example in electron microscopy, and this is at least one reason for their recently raised profile on the scientific horizon. Nanotechnology promises many exciting new applications in the field of nutrition such as salt with increased 'saltiness', enhanced delivery of nutrients in fortified foods and supplements, and less 'fattening' foods[2]. Hilty *et al.*[3] recently showed that by nanosizing micronutrient powders, such as Fe and Zn, it is possible to increase their bioavailability. Similarly, nano-encapsulation or micellar protection can be used to increase the stability and palatability of *n*-3 fatty acids and allow their incorporation in a range of fortified foods[4]. Another thrilling opportunity is the production of a range of low-fat products using double emulsions, where water droplets are placed inside fat droplets to lower the fat content of foods while retaining the same mouthfeel[5].

Nonetheless, the bioavailability of some nutrients remains a challenge to those designing high-quality food supplements and functional foods, and it raises a significant barrier to optimal benefits accrued in their use. One strategy proposed for enhancing the bioavailability of these nutrients is to mimic the body's own strategy in absorbing fats and oils; this may be achieved biologically by incorporating the nutrients into nano-sized liposomes.

In this issue, Liu *et al.* investigated the use of nanoliposomes to encapsulate medium-chain fatty acids (MCFA) with the potential to incorporate them at greater levels in the diet and by this means suppress dietary fat storage as adipose tissue. There is growing literature on the use of MCFA as a weight-control strategy, as they accumulate poorly as body fat, in comparison with long-chain fatty acids, and appear to be able to reduce body weight or body fat mass in animal and human studies[6–11]. Still, the limitations of long-term consumption of a high-MCFA diet, i.e. their low palatability and adverse gastrointestinal (GI)-related effects (such as diarrhoea), need to be addressed if they are to be incorporated to a substantial degree into the human diet. The protocol presented in this issue by Liu *et al.*[12] promises to overcome these difficulties and tailor the residence time of the MCFA in the GI tract by nano-encapsulating the MCFA in lipid liposomes. The main results presented in the paper show, for the first time, that MCFA nanoliposomes can reduce body fat accumulation in mice and that this nano-encapsulation improved the palatability of the MCFA and reduced the GI adverse effects associated with them.

Currently, there is increased public awareness of nanotechnology application to foods (nanofoods), albeit concern over the fact that these nanoparticles may have increased reactivity due to increased surface area, or may bypass the 'normal' body mechanisms that deal with soluble molecules, or even gain access to body compartments not normally accessible to the micrometre-sized or the soluble counterparts could, in some cases, hinder their further development. However, the nanofood applications such as the one described here should be much more benign in terms of public acceptance since the nanostructures resemble natural structures formed in our bodies during the digestion of fats and are very likely to break down in the stomach or gut lumen. At present, the challenge for the food industry will be to create these delivery systems economically for use in a wide range of food applications.

The author has no conflicts of interest.

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