

## CORRESPONDENCE

# Need for public awareness regarding low birth weight and bottle feeding

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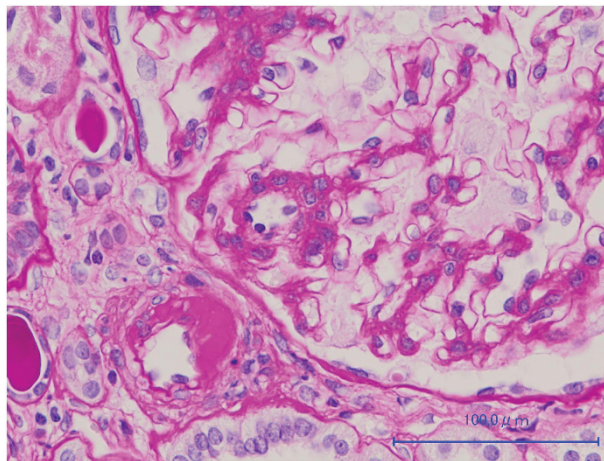
Recently, Ruggajo *et al.*<sup>1</sup> reported the Norwegian registration study regarding low birth weight (LBW) and end-stage renal disease (ESRD). They concluded that LBW, rather than familial factors, is a significant risk for future ESRD. We read the article<sup>1</sup> with great interest because as they cited, we<sup>2</sup> also reported a nationwide study showing strong associations between LBW and ESRD, and reaffirmed the significance of the article by Hosaka *et al.*,<sup>3</sup> which was published in the journal, *Hypertension Research*.

According to a report from United Nations Children's Fund,<sup>4</sup> Norway had the sixth lowest LBW prevalence (5.4%) among 27 developed countries, whereas Japan had the highest LBW prevalence (9.6%). Although the LBW prevalence is higher in Japan, the annual incidences of ESRD in Norway and Japan are similar with 285 and 290 persons per million, respectively, diagnosed each year. However, the ESRD incidences among individuals of <20 years are higher in Japan (0.3%) compared with in Norway (0.03%)<sup>1,5</sup> supporting Ruggajo's hypothesis that LBW strongly affects ESRD onset, especially in persons of <20 years, and they postulated that this association is not explained by familial factors.<sup>1</sup> A good example from our experience serves to illustrate this point: a 20-year-old woman with proteinuria and renal insufficiency exhibited hypertrophic glomeruli and severe arteriosclerosis, which is suggestive of glomerular hypertension, in renal biopsy specimens (Figure 1). These findings are well explained by Barker's fetal origin of adult-age diseases theory and Brenner's hyperfiltration hypothesis. Thus, LBW was accompanied by a low nephron number, resulting in glomerular hypertension and further glomerular injury.<sup>6</sup> These mechanisms were described as a vicious cycle resulting in further nephron loss.<sup>7</sup> The patient was

born as an identical twin, with a birth weight of 2015 g, at 39 weeks gestation and was bottle fed during the newborn period. Her identical twin, who also had LBW but was breastfed, currently had no kidney dysfunction or proteinuria. Because bottle feeding in infancy is unfavorable for later life compared with breastfeeding,<sup>8,9</sup> the patient's renal dysfunction may be attributable to bottle feeding. Breast milk is known to contain hormones, such as leptin, ghrelin and adiponectin, which have long-term 'epigenetic' effects on energy metabolism and on feeding behavior.<sup>10</sup> In addition, using the data from the Tohoku Study of Child Development, Hosaka *et al.*<sup>3</sup> demonstrated that breastfeeding can lower home blood pressure in children at 7 years of age, regardless of their mother's blood pressure.<sup>11</sup> They cited higher

sodium concentrations in formula milk compared with breast milk.<sup>3</sup> This serves as a reminder of the thesis that breastfed babies can learn effective self-regulation of dietary intake and favorable taste preferences.<sup>12</sup>

Even in adult individuals, increases in dietary salt taste stimulate a preference for salty foods. Decreases in the amount of sodium contained in processed food (that is, non-discretionary salt) are needed to reduce national salt consumption <6 g per day. Therefore, we are encouraged by the news that as a first step in this process (political and social approach), the Salt Reduction Committee, Japanese Society of Hypertension, has lobbied relevant government ministries and has succeeded in changing food labeling standards to identify the 'sodium' value as the 'corresponding salt' value.



**Figure 1** Renal biopsy findings in a 20-year-old woman. All glomeruli were enlarged, with diameters of 250 μm. Most arterioles showed prominent subendothelial hyaline deposition equivalent to aH3 grade, using the quantitative criteria for arteriolar hyaline thickening of the Banff 97 classification. Factors known to accompany arteriosclerosis, such as hypertension or diabetes mellitus, were absent, and LBW (low birth weight) was the cause of the findings. PAS (periodic acid-Schiff) stain, original magnification ×400.

In conclusion, as mentioned above, the incidence of LBW has markedly increased in Japan, whereas other developed countries, such as the USA and Canada, have experienced the opposite trend during the same period. The increase in LBW in Japan appears to be attributable to very low mortality among newborn babies, as well as increased numbers of preterm deliveries and multiple gestations, and the drastic desire among Japanese women to be slender. Therefore, we must raise public awareness that maternal malnutrition during pregnancy and bottle feeding in infancy may result in infants having future risks of adult-onset diseases, such as hypertension, ischemic heart disease and chronic kidney disease.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest.

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