

# Dairy and nondairy beverage consumption for childhood atopic eczema: what health advice to give?

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doi:10.1111/ced.12714

## Summary

**Background.** Many parents of children with atopic eczema (AE) practise empirical dietary avoidance and supplementation, and seek healthcare advice on whether consumption of dairy and nondairy beverages may be beneficial or detrimental for this condition.

**Aim.** We investigated if frequency of consumption of beverages was associated with disease severity and quality of life (QoL).

**Methods.** Parent-reported frequency of drinks and beverages were recorded in consecutive children with AE, and disease severity (Nottingham Eczema Severity Score; NESS), QoL (Children's Dermatology Life Quality Index; CDLQI), skin hydration (SH), transepidermal water loss (TEWL), blood pressure (BP), resting heart rate (RHR) and body mass index (BMI) were evaluated.

**Results.** AE was associated with worse QoL than miscellaneous non-AE skin diseases ( $P < 0.001$ ). Compared with children without AE, there was a trend for children with AE to drink less milk ( $P = 0.06$ ) and more miscellaneous beverages (such as Chinese herbal tea and soymilk;  $P = 0.03$ ). In children with AE, NESS correlated with CDLQI ( $\rho = 0.66$ ,  $P < 0.001$ ) and reduced SH ( $\rho = -0.32$ ,  $P < 0.001$ ), whereas CDLQI correlated with a higher RHR ( $\rho = 0.25$ ,  $P < 0.01$ ). Multiple logistic regression showed that male sex (OR = 0.44, 95% CI 0.20–0.97;  $P = 0.04$ ) and drinking fresh milk (OR = 0.42, 95% CI 0.20–0.93;  $P = 0.03$ ) were independent factors associated with less severe disease. Moderate to severe impairment of CDLQI was associated with NESS (OR = 1.48, 95% CI 1.28–1.71;  $P < 0.001$ ) and RHR (OR = 1.05, 95% CI 1.02–1.08;  $P < 0.01$ ) but not with reported habits of beverage consumption. Concerning cardiovascular health in AE, frequency of formula milk consumption was associated with RHR ( $\rho = 0.17$ ,  $P = 0.04$ ), and soft drink consumption was associated with higher systolic blood pressure (SBP) ( $\rho = 0.18$ ,  $P = 0.04$ ).

**Conclusion.** This study provides evidence for parental/patient guidance. Children with AE who reported more fresh milk consumption had less severe disease. There was no correlation between consumption of nondairy beverages with disease severity or QoL, but frequency of soft drink consumption correlated with SBP. With these results being supported by a literature review, it is reasonable to advise parents that fresh milk can be consumed by unsensitized children with AE. Soft drinks and other beverages should not be consumed in excess for optimal cardiovascular health and for other health reasons.

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Conflict of interest: the authors declare that they have no conflicts of interest.

Accepted for publication 23 December 2014

## Introduction

Atopic eczema (AE) is a common chronic relapsing disease in children, associated with significant impaired quality of life (QoL).<sup>1</sup> As there is no definite cure, alternative therapies are extensively used by parents.<sup>2</sup> Various foods and beverages have been

implicated in AE, and many parents of children with AE practise avoidance strategies such as dietary restriction and avoidance of certain foods.<sup>2–4</sup> In particular, milk and dairy products are commonly thought to worsen AE. Sensible avoidance of foods known to exacerbate sensitized individuals is reasonable healthcare advice. However, more often than not, there is no definite history of a temporal association of AE and either exacerbation on consumption, or improvement with avoidance, of many common food items. Although various foods have been extensively investigated, many common beverages have not been studied. Nevertheless, parents may seek advice from healthcare practitioners as to whether consumption of milk and other beverages may be beneficial or detrimental for AE. Physicians often play important roles in providing advice on these practices.

In this study, we investigated whether frequency of consumption of household beverages was associated with disease severity and QoL and performed an extensive literature review about recommendations on beverages for eczema.

## Methods

The Clinical Research Ethics Committee of the Chinese University of Hong Kong approved this study, and all patients or their parents provided informed consent.

### Participants

Beverage consumption habits were recorded by means of a questionnaire.

Patients seen at the paediatric dermatology clinic with a skin disease (AE or non-AE skin condition) were eligible if the condition was confirmed by the physician as AE according to Hanifin and Rajka's criteria, and if the parent was able to give a reliable history of the child's beverage consumption.<sup>5</sup> Exclusion criteria included nonspecific dermatitis, epidermolysis bullosa or acrodermatitis enteropathica, or if diagnosis was unclear.

Between January 2013 and January 2014, 142 children with AE and 28 children without AE who had miscellaneous skin conditions (warts, scabies, onychomycosis, skin hyperpigmentation, psoriasis, alopecia, vitiligo, naevi) were evaluated. Demographic characteristics are shown in Table 1.

Correlations between the type and amount of weekly beverage intake, AE severity (Nottingham Eczema Severity Score; NESS)<sup>6</sup> and QoL (Children's Dermatol-

ogy Life Quality Index; CDLQI)<sup>1</sup> were evaluated. NESS is a simple and easily performed test that assesses the symptoms of eczema over the preceding 12 months.<sup>6</sup> NESS is performed on patients > 1 year old, and CDLQI on children > 5 years old. Together, NESS and CDLQI encompass both the symptoms and signs of AE.

Average beverage consumption (in days/week and times/day over the past 4 weeks by recall) was recorded. As consumption of dairy products and beverages may affect growth [body weight, height, body mass index (BMI), BMI percentiles] and cardiovascular health [resting heart rate (RHR), resting systolic and diastolic blood pressures (SBP, DBP)], these parameters were also recorded.

BP and RHR were measured over the patient's brachial artery with a BP monitor (Accutorr Plus; Data-scope Corp, Montvale, NJ, USA) at the end of the interview, during which the patient had been seated for about 30 min. BP measured over the brachial artery accurately reflects BP in the central circulation. In the adult population, age-specific usual BP is strongly and directly related to vascular and overall mortality.<sup>7</sup>

### Statistical analysis

Spearman coefficient was used to analyse the correlations between clinical indices and drinking habits unless otherwise stated. All comparisons were two-

**Table 1** Demographics of children with and without AE.

| Demographics*             | Participants           |                      | P†      |
|---------------------------|------------------------|----------------------|---------|
|                           | Without AE<br>(n = 28) | With AE<br>(n = 142) |         |
| M/F, n (%)‡               | 17 (60.7)              | 74 (52.1)            | 0.40    |
| Age, years                | 12.2 ± 4.6             | 12.0 ± 5.0           | 0.76    |
| CDLQI                     | 3.1 ± 4.2              | 8.2 ± 5.7            | < 0.001 |
| Skin hydration, AU        | 34.3 ± 10.6            | 35.7 ± 12.9          | 0.85    |
| TEWL, g/m <sup>2</sup> /h | 10.0 ± 1.8             | 11.5 ± 1.4           | < 0.001 |
| Body weight, kg           | 44.1 ± 24.9            | 39.9 ± 17.9          | 0.72    |
| Height, cm                | 145.4 ± 23.9           | 141.5 ± 23.9         | 0.37    |
| BMI, kg/m <sup>2</sup>    | 19.4 ± 6.5             | 18.7 ± 3.8           | 0.66    |
| BMI percentile            | 43.1 ± 33.9            | 47.5 ± 32.6          | 0.54    |
| SBP, mmHg                 | 111.0 ± 11.9           | 109.4 ± 16.2         | 0.29    |
| DBP, mmHg                 | 67.2 ± 6.7             | 67.0 ± 11.4          | 0.79    |
| RHR, beats/min            | 78.8 ± 12.3            | 82.8 ± 15.5          | 0.19    |

AE, atopic eczema; AU, arbitrary unit; BMI, body mass index; CDLQI, Children's Dermatology Life Quality Index; DBP, diastolic blood pressure; RHR, resting heart rate; SBP, systolic blood pressure; TEWL, transepidermal water loss. \*All data are mean ± SD, unless otherwise stated; † $\chi^2$  test; all others were Mann-Whitney U-test; ‡age at assessment.

tailed and  $P < 0.05$  was considered to be statistically significant.

## Results

There was generally no difference in body weight, height or BMI (Table 1) or beverage preference (Table 2) between the two groups. Children with AE had significantly poorer QoL ( $P < 0.001$ ) and higher TEWL ( $P < 0.001$ ) than children without AE (Table 1). Fewer children with AE drank fresh milk (trend,  $P = 0.06$ ) but more drank miscellaneous beverages (such as Chinese herbal tea and soymilk) ( $P = 0.03$ ) (Table 2).

### Eczema severity and quality of life

In AE, NESS correlated with CDLQI ( $\rho = 0.66$ ,  $P < 0.001$ ) and with reduced SH ( $\rho = -0.32$ ,  $P < 0.001$ ), whereas CDLQI correlated with a higher RHR ( $\rho = 0.25$ ,  $P = 0.003$ ) (Table 3). These correlations existed after adjustment for sex, age at assessment, height, BMI and BMI percentile. Multiple logistic regression showed that male sex (OR = 0.44, 95% CI 0.20–0.97;  $P = 0.04$ ) (Table 4) and fresh milk drinking (OR = 0.42, 95% CI 0.20–0.93;  $P = 0.03$ ) (Table 5) were independent factors associated with mild disease severity ( $n = 142$  children with AE), while moderate to severe impairment of QoL was associated with disease severity by NESS (OR = 1.48, 95% CI 1.28–1.71;  $P < 0.001$ ) and RHR (OR = 1.05, 95% CI 1.02–1.08,  $P < 0.01$ ) (Table 6). There were no significant differences in beverage choice between patients with no/mild effect and those with moderate/severe effect of AE on QoL (Table 7).

### Cardiovascular health and blood pressure

Concerning cardiovascular health in AE, frequency of formula milk consumption was associated with higher RHR ( $\rho = 0.17$ ,  $P = 0.04$ ), soft drink consumption was associated with higher SBP ( $\rho = 0.18$ ,  $P = 0.04$ ) and coffee consumption was associated with lower DBP ( $\rho = -0.16$ , trend,  $P = 0.07$ ).

When all participants (with and without AE;  $n = 170$ ) were assessed (and again adjusting for sex, age of assessment, body weight, height, BMI and BMI percentile), fresh milk consumption was significantly associated with lower SBP ( $\rho = -0.17$ ,  $P = 0.04$ ), whereas formula milk consumption was significantly associated with higher SBP ( $\rho = 0.18$ ,  $P = 0.02$ ) and RHR ( $\rho = 0.17$ ,  $P = 0.03$ ). While coffee consumption

**Table 2** Drinking habits of children with and without atopic eczema.

| Beverage     | Without AE ( $n = 28$ ) |                  | Without AE ( $n = 142$ ) |                  | <i>P</i> |
|--------------|-------------------------|------------------|--------------------------|------------------|----------|
|              | Yes, <i>n</i> (%)       | No, <i>n</i> (%) | Yes, <i>n</i> (%)        | No, <i>n</i> (%) |          |
| Soft drinks  |                         |                  |                          |                  |          |
| Regular      | 18 (64.3)               | 10 (35.7)        | 72 (50.7)                | 70 (49.3)        | 0.19     |
| Diet         | 5 (17.9)                | 23 (82.1)        | 24 (16.9)                | 118 (83.1)       | 1.00*    |
| Fruit juices | 21 (75.0)               | 7 (25)           | 87 (61.3)                | 55 (38.7)        | 0.17     |
| Fresh milk   | 19 (67.9)               | 9 (32.1)         | 69 (48.6)                | 73 (51.4)        | 0.06     |
| Formula milk | 4 (14.3)                | 24 (85.7)        | 19 (13.4)                | 123 (86.6)       | 1.00*    |
| Tea          | 13 (46.4)               | 15 (53.6)        | 52 (36.6)                | 90 (63.4)        | 0.33     |
| Coffee       | 5 (17.9)                | 23 (82.1)        | 15 (10.6)                | 127 (89.4)       | 0.33*    |
| Other†       | 4 (14.3)                | 24 (85.7)        | 50 (35.2)                | 92 (64.8)        | 0.03     |

\*Fisher exact test (other results were  $\chi^2$  test); †Chinese herbal tea, soymilk, nutrition shakes (Pediasure®), lemon tea, milk tea, chocolate milk, yogurt.

was negatively associated with DBP ( $\rho = -0.16$ ,  $P < 0.05$ ).

## Discussion

Milk as a dairy beverage is often restricted by parents of children with AE in western countries, but less so among the southeast Chinese population in Hong Kong.<sup>2</sup> Based on our observation, male sex (OR = 0.44, 95% CI 0.20–0.97;  $P = 0.042$ ) and drinking fresh milk (OR = 0.42, 95% CI 0.20–0.93;  $P = 0.031$ ) are independent factors associated with mild AE severity. It is not known if children with severe AE avoid drinking fresh milk, or whether fresh milk can decrease the severity of AE. As a general principle, a detailed dietary history should be obtained from all children with AE before giving dietary advice. In patients whose AE is not exacerbated by drinking fresh milk or improved by its avoidance, it may be advocated. As for other beverages such as formula milk, fruit juice, carbonated soft drinks, tea or coffee, it is sensible to advise that these beverages should be consumed in moderation. Excessive consumption of any of these beverages should be discouraged for various cardiovascular and metabolic health reasons.

QoL is an important outcome measure that correlates with disease severity.<sup>1,8</sup> In this study, we found that moderate to severe impairment of CDLQI was associated with disease severity as measured by NESS (OR = 1.45;  $P < 0.001$ ) and RHR (OR = 1.05, 1.02–1.08,  $P = 0.002$ ). High RHR may reflect high baseline stress levels or suboptimal cardiovascular or

**Table 3** Spearman rank correlation analysis of NESS and CDLQI with the clinical features and drinking habits of children with AE.

|                      | NESS   | CDLQI |
|----------------------|--------|-------|
| Clinical variable    |        |       |
| CDLQI                | 0.66*  |       |
| Skin hydration, AU   | -0.32* | -0.14 |
| TEWL                 | 0.03   | 0.03  |
| Age, years†          | -0.03  | -0.09 |
| Body weight, kg      | -0.03  | -0.13 |
| Height, cm           | -0.05  | -0.12 |
| BMI                  | -0.01  | -0.10 |
| BMI percentile       | 0.02   | -0.06 |
| DBP, mmHg            | 0.03   | -0.08 |
| DBP, mmHg            | 0.07   | -0.01 |
| RHR, beats/min       | 0.11   | 0.25* |
| Beverage, times/week |        |       |
| Soft drinks          |        |       |
| Regular              | -0.07  | -0.08 |
| Diet                 | -0.11  | -0.07 |
| Fruit juice          | 0.07   | 0.00  |
| Fresh milk           | -0.20* | -0.05 |
| Formula milk         | 0.07   | 0.04  |
| Tea                  | -0.06  | -0.06 |
| Coffee               | -0.09  | -0.02 |
| Other‡               | -0.04  | 0.04  |

AE, atopic eczema; AU, arbitrary unit; BMI, body mass index; CDLQI, Children's Dermatology Life Quality Index; DBP, diastolic blood pressure; NESS, Nottingham Eczema Severity Score; RHR, resting heart rate; SBP, systolic blood pressure; TEWL, transepidermal water loss. \* $P = 0.05$  (two-tailed); †age at assessment; ‡Chinese herbal tea, soymilk, nutrition shakes (Pediasure®), lemon tea, milk tea, chocolate milk, yogurt. Similar correlation results were obtained after adjustment for sex, age, height, BMI and BMI percentile. Frequency of fresh milk drinking correlated negatively with NESS ( $\rho = -0.20$ ,  $P = 0.02$ ) and with frequency of other drinks ( $\rho = -0.20$ ,  $P = 0.02$ ).

metabolic health.<sup>9</sup> QoL in children with AE generally correlated with the psychological symptoms of stress, anxiety and even depression.<sup>8</sup> Interestingly, frequency of formula milk consumption was positively associated with RHR ( $P = 0.04$ ), and soft drink consumption with higher SBP ( $P = 0.04$ ) in children with AE. When all children with and without AE were assessed together ( $n = 170$ ), fresh milk consumption was significantly associated with lower SBP ( $P = 0.02$ ), formula milk consumption was significantly associated with higher SBP ( $P = 0.02$ ) and RHR ( $P = 0.03$ ), and coffee consumption was negatively associated with DBP ( $P < 0.05$ ). Based on these observations, it seems reasonable to advise children to drink fresh rather than formula milk, and to drink other beverages in moderation for optimal cardiovascular and metabolic health.<sup>7</sup>

**Table 4** Demographics of children with mild and children with moderate to severe eczema (classified by NESS).

| Demographics*                 | Mild ( $n = 38$ ) | Moderate/severe ( $n = 104$ ) | $P$        |
|-------------------------------|-------------------|-------------------------------|------------|
| M/F, $n$ (%)                  | 25 (65.8)         | 49 (47.1)                     | $< 0.05$   |
| Age, years†                   | $10.6 \pm 5.4$    | $12.5 \pm 4.7$                | 0.06       |
| CDLQI                         | $4.1 \pm 3.5$     | $9.8 \pm 5.6$                 | $< 0.001‡$ |
| Skin hydration, AU            | $38.6 \pm 10.7$   | $34.6 \pm 13.5$               | $0.06‡$    |
| TEWL, $\text{g/m}^2/\text{h}$ | $11.2 \pm 0.9$    | $11.6 \pm 1.5$                | 0.06       |
| Body weight, kg               | $35.2 \pm 16.7$   | $41.6 \pm 18.0$               | $0.07‡$    |
| Height, cm                    | $135.8 \pm 26.0$  | $143.6 \pm 22.9$              | $0.13‡$    |
| BMI, $\text{kg/m}^2$          | $17.8 \pm 3.2$    | $19.0 \pm 4.0$                | $0.15‡$    |
| BMI percentile                | $47.6 \pm 32.0$   | $47.5 \pm 33.0$               | $0.87‡$    |
| SBP, mmHg                     | $106.3 \pm 18.8$  | $110.5 \pm 15.1$              | $0.07‡$    |
| DBP, mmHg                     | $64.9 \pm 12.1$   | $67.8 \pm 11.1$               | $0.05‡$    |
| RHR, beats/min                | $83.5 \pm 14.0$   | $82.6 \pm 16.0$               | 0.75       |

AU, arbitrary unit; BMI, body mass index; CDLQI, Children's Dermatology Life Quality Index; DBP, diastolic blood pressure; RHR, resting heart rate; SBP, systolic blood pressure; TEWL, transepidermal water loss. \*All numerical data are mean  $\pm$  SD, unless otherwise stated; †Mann-Whitney  $U$ -test.

**Table 5** Drinking habits of children with mild and moderate to severe eczema (classified by NESS).

| Beverage     | Mild AE ( $n = 38$ ) |             | Moderate/severe AE ( $n = 104$ ) |             | $P$     |
|--------------|----------------------|-------------|----------------------------------|-------------|---------|
|              | Yes, $n$ (%)         | No, $n$ (%) | Yes, $n$ (%)                     | No, $n$ (%) |         |
| Soft drinks  |                      |             |                                  |             |         |
| Regular      | 21 (55.3)            | 17 (44.7)   | 51 (49.0)                        | 53 (51.0)   | 0.51    |
| Diet         | 7 (18.4)             | 31 (81.6)   | 17 (16.3)                        | 87 (83.7)   | 0.77    |
| Fruit juices | 24 (63.2)            | 14 (36.8)   | 63 (60.6)                        | 41 (39.4)   | 0.78    |
| Fresh milk   | 24 (63.2)            | 14 (36.8)   | 45 (43.3)                        | 59 (56.7)   | 0.04    |
| Formula milk | 6 (15.8)             | 32 (84.2)   | 13 (12.5)                        | 91 (87.5)   | 0.61    |
| Tea          | 12 (31.6)            | 26 (68.4)   | 40 (38.5)                        | 64 (61.5)   | 0.45    |
| Coffee       | 4 (10.5)             | 34 (89.5)   | 11 (10.6)                        | 93 (89.4)   | $1.00†$ |
| Other‡       | 17 (44.7)            | 21 (55.3)   | 33 (31.7)                        | 71 (68.3)   | 0.15    |

†AE, atopic eczema.  $\chi^2$  was calculated only if all expected cell frequencies were equal or greater than 5; otherwise, Fisher exact test was performed.; ‡Chinese herbal tea, soymilk, nutrition shakes (Pediasure), lemon tea, milk tea, chocolate milk, yogurt.

The practice of multiple food avoidance and dietary supplementation is often ill-advised.<sup>2</sup> Such practices are not without harm and may occasional lead to grave sequelae. Our cross-sectional study consistently demonstrated that the type of beverage consumed may be associated with disease severity, QoL and cardiovascular effects. Dietary practices by parents are usually empirical and advice is not sought from a doctor.<sup>2</sup> Interestingly, milk sensitization, empirical milk avoidance or AE aggravation are all relatively uncommon among the Chinese beyond infancy.<sup>2</sup> Dietary practices are cultural and may vary from country

**Table 6** Demographics of children with AE with no/mild and moderate/severe effect of their disease on QoL.

| Demographics*             | No/mild effect<br>(n = 64) | Moderate/severe<br>effect (n = 78) | P†      |
|---------------------------|----------------------------|------------------------------------|---------|
| M/F, n (%)                | 33 (51.6)                  | 41 (52.6)                          | 0.92    |
| Age, years‡               | 12.3 ± 4.9                 | 11.7 ± 5.0                         | 0.39    |
| NESS                      | 8.3 ± 3.0                  | 11.9 ± 2.9                         | < 0.001 |
| Skin hydration, AU        | 37.1 ± 11.7                | 34.6 ± 13.8                        | 0.12    |
| TEWL, g/m <sup>2</sup> /h | 11.4 ± 1.1                 | 11.5 ± 1.6                         | 0.79    |
| Body weight, kg           | 42.6 ± 18.4                | 37.7 ± 17.2                        | 0.11    |
| Height, cm                | 144.4 ± 23.3               | 139.2 ± 24.3                       | 0.20    |
| BMI, kg/m <sup>2</sup>    | 19.2 ± 4.0                 | 18.2 ± 3.7                         | 0.13    |
| BMI percentile            | 52.0 ± 33.4                | 43.9 ± 31.7                        | 0.21    |
| SBP, mmHg                 | 110.5 ± 18.1               | 108.5 ± 14.6                       | 0.51    |
| DBP, mmHg                 | 68.0 ± 11.3                | 66.2 ± 11.6                        | 0.52    |
| RHR, beats/min            | 78.4 ± 14.6                | 86.5 ± 15.3                        | < 0.01  |

AE, atopic eczema; AU, arbitrary unit; BMI, body mass index; DBP, diastolic blood pressure; NESS, Nottingham Eczema Severity Score; QoL, quality of life; RHR, resting heart rate; SBP, systolic blood pressure; TEWL, transepidermal water loss. \*All data are mean ± SD, unless otherwise stated; † $\chi^2$  test; all others were Mann-Whitney U-test; ‡age at assessment.

**Table 7** Drinking habits of children with AE with no/mild and moderate/severe effect of their disease on QoL.

| Beverage     | No/mild effect<br>(n = 64) |           | Moderate/severe<br>effect<br>(n = 78) |           | P    |
|--------------|----------------------------|-----------|---------------------------------------|-----------|------|
|              | Yes, n (%)                 | No, n (%) | Yes, n (%)                            | No, n (%) |      |
| Soft drinks  |                            |           |                                       |           |      |
| Regular      | 36 (56.2)                  | 28 (43.8) | 36 (46.2)                             | 42 (53.8) | 0.23 |
| Diet         | 13 (20.3)                  | 51 (79.7) | 11 (14.1)                             | 67 (85.9) | 0.33 |
| Fruit juices | 42 (65.6)                  | 22 (34.4) | 45 (57.7)                             | 33 (82.3) | 0.33 |
| Fresh milk   | 34 (53.1)                  | 30 (46.9) | 35 (44.9)                             | 43 (55.1) | 0.33 |
| Formula milk | 7 (10.9)                   | 57 (89.1) | 12 (15.4)                             | 66 (84.6) | 0.44 |
| Tea          | 26 (40.6)                  | 38 (59.4) | 26 (33.3)                             | 52 (66.7) | 0.37 |
| Coffee       | 7 (10.9)                   | 57 (89.1) | 8 (10.3)                              | 70 (89.7) | 0.90 |
| Other†       | 21 (32.8)                  | 43 (67.2) | 29 (37.2)                             | 49 (62.8) | 0.59 |

AE, atopic eczema; QoL, quality of life. †Chinese herbal tea, soy-milk, nutrition shakes (Pediasure), lemon tea, milk tea, chocolate milk, yogurt.

to country. Instead of giving nonspecific dietary advice or adopting guidelines from another culture, it is important to tailor instructions to individuals for optimal adherence. Nevertheless, the generalizability and external validity of our recommendations is important. It is important to explore if prospective studies are available to establish causations and to support our recommendations. We therefore carried out a review of literature on MEDLINE, using the search words of 'AE' AND 'dietary advice', 'beverage', 'dairy', 'formula

milk', 'fresh milk', 'coffee', 'tea', 'juice', 'drink', 'soft drink' and 'alcoholic beverage', which gave 17, 410, 172, 13,10, 25, 14, 6, 0 and 7 results, respectively. Many of these references were irrelevant to our subject matter. These papers, together with their references, were evaluated as an evidence base for recommendations. Their conclusions are summarized in Table 8.

In general, avoidance of cow milk is recommended for young children with AE who are sensitized to cow milk.<sup>4,10–17</sup> There is no good evidence that restriction of cow milk is either beneficial or detrimental in older AE children who are not sensitized to cow milk. The GABRIELA study reported a protective effect of farm milk consumption on childhood asthma and atopy, possibly attributable to the whey protein fraction of milk.<sup>18</sup> Together with our finding that children with AE who reported more fresh milk consumption have less severe disease, we recommend that cow milk is generally a safe beverage for unsensitized children with AE.<sup>18</sup>

Coffee is generally not a regular beverage for children and teenagers. There are only two nonspecific reports indicating that coffee may aggravate AE.<sup>19,20</sup> Hence, we recommend that coffee should be avoided by sensitized children with AE, and consumed in moderation by otherwise unsensitized young patients.

Tea is also not a regular beverage for children and teenagers in many countries. We found one report that oolong tea drunk three times a day (total 1 litre) is beneficial for AE.<sup>21</sup> Further studies are warranted to quantify the efficacy of tea in AE. However, it may be difficult to persuade children to drink 1 litre of oolong tea each day.

There is generally a paucity of evidence for any association between juice consumption and effects on AE.<sup>10</sup> Given that juices are generally sweetened and have high calorie contents, they should be avoided, and children should be encouraged to eat fruits instead. Soft drinks are also usually sweetened, and we recommend avoidance or consumption in moderation.<sup>11,12</sup> There is no good evidence that AE is aggravated by alcoholic beverages; however, alcoholic beverages are generally not recommended for young people. For older teenagers, avoidance or social consumption in moderation is again recommended.<sup>13,14</sup>

Ideally, the exact amount of beverages consumed should be recorded. The volume consumed may be more important than the frequency consumed. However, it is rather difficult to accurately record the exact amount of beverages consumed in a survey like this. Our problem is also shared by other investigators, who generally do not record exact amounts. In future stud-

**Table 8** Results from literature review of dietary advice for beverages in childhood AE.

| Population                     | Design                                 | Advice                                                                                                                                                                                                                                                                                                            | Remarks                                                                                         | Ref.                                            |
|--------------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Cow milk<br>39 adults          | Double-blind<br>cross-over study       | Supplementation of a dairy drink with milk phospholipids has no beneficial effect on skin parameters compared with consumption of whole milk in children with atopic dermatitis                                                                                                                                   | ScorAD only                                                                                     | Keller <i>et al.</i> , 2014 <sup>15</sup>       |
| 252 children                   | RCT                                    | The significant preventive effect on the cumulative incidence of AE of partially hydrolysed whey formula and extensively hydrolysed casein formula persisted for 10 years without rebound, whereas extensively hydrolysed whey formula showed no significant risk reduction                                       | Study incidence or risk of AE, but not AE severity                                              | von Berg <i>et al.</i> , 2013 <sup>17</sup>     |
| 32 paediatric patients         | Cohort                                 | Food IgE, IgA and IgG, severity, QoL, and GAT following food avoidance. Children with low casein, milk or whey IgG improved following avoidance of cow milk                                                                                                                                                       | Small study, no infants                                                                         | Wantke <i>et al.</i> , 1993 <sup>14</sup>       |
| 62 children                    | Cohort                                 | Dietary restriction including soda, milk and dairy products. Significant improvement of AE symptom was observed in the nonrestricted group                                                                                                                                                                        | ScorAD only                                                                                     | Limr <i>et al.</i> , 2013 <sup>11</sup>         |
| 6857 children<br>< 3 years     | Systematic review, 21 studies          | Conflicting findings in preventing AE development and reducing its severity were reported from different research groups that performed supplementation with an amino acid-based formula                                                                                                                          | Cow milk not worse or better                                                                    | Foolad <i>et al.</i> , 2013 <sup>16</sup>       |
|                                | Systematic review                      | No benefit from avoiding milk                                                                                                                                                                                                                                                                                     | Systematic review                                                                               | Williams <i>et al.</i> , 2010 <sup>22</sup>     |
| 2252 newborns                  | RCT of 3 milk formulae                 | Reduced risk of AE with partially hydrolysed whey formula (0.79, 95% CI, 0.64–0.97), extensively hydrolysed whey formula (0.92, 95% CI, 0.76–1.11) and extensively hydrolysed casein formula (0.71 (95% CI, 0.58–0.88) compared with cow milk formula                                                             | Disease severity or QoL not studied                                                             | von Berg <i>et al.</i> , 2008. <sup>23</sup>    |
| 288 participants               | 9 RCTs                                 | No benefit of an egg- and milk-free diet in unselected participants with AE                                                                                                                                                                                                                                       | Cochrane review                                                                                 | Bath-Hextal <i>et al.</i> , 2008. <sup>24</sup> |
| 120 infants                    | RCT on food and HDM allergen avoidance | Strict food and HDM allergen avoidance should be considered for prevention of allergy in high-risk infants                                                                                                                                                                                                        | Disease prevention, but not disease severity                                                    | Arshad <i>et al.</i> , 2007 <sup>25</sup>       |
| 46 infants with atopic parents | Cohort                                 | Partially hydrolysed formula reduced the risk of AE and food allergy development, and was probably an effective primary intervention method for infants at high risk for atopy                                                                                                                                    | Incidence but not severity of AE in young infants<br>Significance in older children not studied | Shao <i>et al.</i> , 2006 <sup>26</sup>         |
| 359 infants                    | Prospective case–control study         | Exclusive breastfeeding and/or hydrolysed milk feeding, delayed and selective introduction of solid foods, and environmental advice were effective at the third year of follow-up, greatly reducing allergic manifestations in babies with high atopic risk compared with those not receiving these interventions | Toddlers with cow milk sensitization, not older children with AE                                | Marini <i>et al.</i> , 1996 <sup>27</sup>       |

Table 8. continued

| Population                                        | Design                 | Advice                                                                                                                                                                                                                                                                                                                                                                             | Remarks                                                                                    | Ref.                                                     |
|---------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Coffee                                            |                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |                                                          |
| 92 infants                                        | Cohort                 | Indirect evidence that breastfed infants had worsened AE when mother consumed coffee                                                                                                                                                                                                                                                                                               | No relevance to older children with AE                                                     | Uenishi <i>et al.</i> , 2011 <sup>19</sup>               |
| 195 adults                                        | Cohort, open challenge | Unpredictable, irregular aggravation of AE in some patients                                                                                                                                                                                                                                                                                                                        | Uncertain relevance to children and teenagers                                              | Uenishi <i>et al.</i> , 2003 <sup>20</sup>               |
| Tea                                               |                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |                                                          |
| 118 participants (mean age 24 years; range 16–58) | Open                   | Marked to moderate improvement of recalcitrant AE with oolong tea. The beneficial effect was first noticed after 1 or 2 weeks of treatment. A good response to treatment was still observed in 64 patients (54%) at 6 months                                                                                                                                                       | The only large open-label study existing on oolong tea in the treatment of recalcitrant AD | Uehara <i>et al.</i> , 2001 <sup>21</sup>                |
| Juice                                             |                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |                                                          |
| 495 children                                      | Cohort                 | No evidence for an association between early introduction of nonmilk fluids (fruit syrup, orange juice, sterilized water, vitamins and honey) in infancy and childhood atopic disease. Sterilized water was a significant risk factor for asthma                                                                                                                                   | No correlation data with disease severity                                                  | Andreasyan <i>et al.</i> , 2007 <sup>10</sup>            |
| Soft drinks                                       |                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |                                                          |
| 62 children                                       | Cohort                 | Dietary restriction including soda, milk and dairy products. Significant improvement of AD symptom was observed in the nonrestricted group                                                                                                                                                                                                                                         | ScorAD only                                                                                | Lim <i>et al.</i> , 2013 <sup>11</sup>                   |
| 112 children                                      | Descriptive series     | Soft drinks preserved with sulphur dioxide are triggers                                                                                                                                                                                                                                                                                                                            | Therapeutic efficacy of avoidance not addressed                                            | Steinman <i>et al.</i> , 1994 <sup>12</sup>              |
| Alcoholic beverages                               |                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                            |                                                          |
| 13 adults                                         | Experimental           | Immediate hypersensitivity to bakery, brewery and wine products in yeast-sensitive children with AE. The beer, bread, red wine and sparkling wine extracts elicited immediate reactions. However, no evident correlation with suspected symptoms was observed. White wine extract caused reactions in 4/6 children with AE with symptoms, and in 5/7 symptom-free children with AE | White wine. No significant adverse effects with beer and other wines                       | Korekangas-Savolainen <i>et al.</i> , 1994 <sup>13</sup> |
| 100 adults                                        | Cohort                 | After ingestion of food rich in histamine, a clearcut recurrence of AE was seen in 50% of the patients affected. Histamine plays a major part in food and wine intolerance. Histamine in food causes worsening of symptoms in atopic patients and in patients experiencing headache                                                                                                | Histamine in certain wines                                                                 | Wantke <i>et al.</i> , 1993 <sup>14</sup>                |

AE, atopic eczema; HDM, house dust mite; GAT, global/general acceptability of treatment; QoL, quality of life; RCT, randomized controlled trial; ScorAD, Scoring Atopic Dermatitis.

ies on beverage consumption, a validated food frequency questionnaire with pictures of standard cup and glass sizes would document the amount of each beverage consumed and overcome this problem. The types of nondairy beverages are also important. Orange and fruit juice, for example, may be allergenic compared with other nondairy beverages. However, we do not find any relevant association of fruit juices with AE severity or QoL.

## Conclusion

This study provides evidence for parental/patient guidance. Children with AE who reported more fresh milk consumption had less severe disease. There was no correlation between consumption of nondairy beverages with disease severity or QoL, but frequency of soft drink consumption correlated with SBP. Backed by our literature review, it is reasonable to advise parents that fresh milk can be consumed by unsensitized children with AE. Soft drinks and other beverages should not be consumed in excess for optimal cardiovascular health and for other health reasons.

### What's already known about this topic?

- AE is a common childhood skin disease, associated with much misunderstanding about its management.
- Anxious parents often seek health advice, but the advice that physicians give is often not evidence-based.

### What does this study add?

- This study provides evidence about the association between AE and beverages for parental/patient guidance.
- Children with AE who reported more fresh milk consumption have less severe disease.
- There is no correlation between consumption of nondairy beverages with disease severity or QoL, but frequency of soft drink consumption correlates with SBP.
- It seems reasonable to advise children to drink fresh milk instead of other beverages.
- Soft drinks should be consumed in moderation for optimal cardiovascular and metabolic health.

## References

- 1 Hon KL, Kam WY, Lam MC *et al.* CDLQI, SCORAD and NESS: are they correlated? *Qual Life Res* 2006; **15**: 1551–8.
- 2 Hon KL, Leung TF, Kam WY *et al.* Dietary restriction and supplementation in children with atopic eczema. *Clin Exp Dermatol* 2006; **31**: 187–91.
- 3 Hon KL, Leung TF, Lam MC *et al.* Eczema exacerbation and food atopy beyond infancy: how should we advise Chinese parents about dietary history, eczema severity, and skin prick testing? *Adv Ther* 2007; **24**: 223–30.
- 4 Hon KL, Poon TC, Pong NH *et al.* Specific IgG and IgA of common foods in Chinese children with eczema: friend or foe. *J Dermatolog Treat* 2014; **25**: 462–6.
- 5 Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol (Stockh)* 1980; **2**: 44–7.
- 6 Hon KL, Ma KC, Wong E *et al.* Validation of a self-administered questionnaire in Chinese in the assessment of eczema severity. *Pediatr Dermatol* 2003; **20**: 465–9.
- 7 Lewington S, Clarke R, Qizilbash N *et al.* Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002; **360**: 1903–13.
- 8 Hon KL, Pong NH, Poon TC *et al.* Quality of life and psychosocial issues are important outcome measures in eczema treatment. *J Dermatolog Treat* 2015; **26**: 83–9.
- 9 Benes J, Kotrc M, Borlaug BA *et al.* Resting heart rate and heart rate reserve in advanced heart failure have distinct pathophysiologic correlates and prognostic impact: a prospective pilot study. *JACC Heart Fail* 2013; **1**: 259–66.
- 10 Andreasyan K, Ponsonby AL, Dwyer T *et al.* Infant feeding and childhood atopy: does early introduction of non-milk fluids matter? *Pediatr Allergy Immunol* 2007; **18**: 250–7.
- 11 Lim H, Song K, Kim R *et al.* Nutrient intake and food restriction in children with atopic dermatitis. *Clin Nutr Res* 2013; **2**: 52–8.
- 12 Steinman HA, Potter PC. The precipitation of symptoms by common foods in children with atopic dermatitis. *Allergy Proc* 1994; **15**: 203–10.
- 13 Kortekangas-Savolainen O, Savolainen J *et al.* Immediate hypersensitivity to bakery, brewery and wine products in yeast-sensitive atopic dermatitis patients. *Clin Exp Allergy* 1994; **24**: 836–42.
- 14 Wantke F, Gotz M, Jarisch R. The histamine-free diet (in German). *Hautarzt* 1993; **44**: 512–16.
- 15 Keller S, Le HY, Rodiger C *et al.* Supplementation of a dairy drink enriched with milk phospholipids in patients with atopic dermatitis – a double-blind, placebo-controlled, randomized, cross-over study. *Clin Nutr* 2014; **33**: 1010–16.

- 16 Foolad N, Brezinski EA, Chase EP, Armstrong AW. Effect of nutrient supplementation on atopic dermatitis in children: a systematic review of probiotics, prebiotics, formula, and fatty acids. *JAMA Dermatol* 2013; **149**: 350–5.
- 17 von Berg A, Filipiak-Pittroff B, Kramer U *et al.* Allergies in high-risk schoolchildren after early intervention with cow's milk protein hydrolysates: 10-year results from the German Infant Nutritional Intervention (GINI) study. *J Allergy Clin Immunol* 2013; **131**: 1565–73.
- 18 Loss G, Apprich S, Waser M *et al.* The protective effect of farm milk consumption on childhood asthma and atopy: the GABRIELA study. *J Allergy Clin Immunol* 2011; **128**: 766–73.
- 19 Uenishi T, Sugiura H, Tanaka T, Uehara M. Aggravation of atopic dermatitis in breast-fed infants by tree nut-related foods and fermented foods in breast milk. *J Dermatol* 2011; **38**: 140–5.
- 20 Uenishi T, Sugiura H, Uehara M. Role of foods in irregular aggravation of atopic dermatitis. *J Dermatol* 2003; **30**: 91–7.
- 21 Uehara M, Sugiura H, Sakurai K. A trial of oolong tea in the management of recalcitrant atopic dermatitis. *Arch Dermatol* 2001; **137**: 42–3.
- 22 Williams HC, Grindlay DJ. What's new in atopic eczema? An analysis of systematic reviews published in 2007 and 2008. Part 2. Disease prevention and treatment *Clin Exp Dermatol* 2010; **35**: 223–7.
- 23 von Berg A, Filipiak-Pittroff B, Kramer U *et al.* Preventive effect of hydrolyzed infant formulas persists until age 6 years: long-term results from the German Infant Nutritional Intervention Study (GINI). *J Allergy Clin Immunol* 2008; **121**: 1442–7.
- 24 Bath-Hextall F, Delamere FM, Williams HC. Dietary exclusions for established atopic eczema. *Cochrane Database Syst Rev* 2008; (1): CD005203.
- 25 Arshad SH, Bateman B, Sadeghnejad A *et al.* Prevention of allergic disease during childhood by allergen avoidance: the Isle of Wight prevention study. *J Allergy Clin Immunol* 2007; **119**: 307–13.
- 26 Shao J, Sheng J, Dong W *et al.* Effects of feeding intervention on development of eczema in atopy high-risk infants: an 18-month follow-up study (in Chinese) *Zhonghua Er Ke Za Zhi* 2006; **44**: 684–7.
- 27 Marini A, Agosti M, Motta G, Mosca F. Effects of a dietary and environmental prevention programme on the incidence of allergic symptoms in high atopic risk infants: three years' follow-up. *Acta Paediatr Suppl* 1996; **414**: 1–21.