ABSTRACT

Objectives  Our study aimed to compare the quality of life (QoL) between Chinese developmental dyslexia (DD) and healthy children.

Design  A cross-sectional study.

Setting  The participants were recruited from grades 3–6 in six primary schools in Tianmen, a city of Hubei Province, China.

Participants  A total of 5679 students were recruited. After excluding children with visual and auditory dysfunction or psychiatric diseases or with a response rate on the scales or questionnaires of less than 90%, 5352 children were finally included in the analysis. DD children were diagnosed according to their clinical symptoms, which were mainly assessed by the Dyslexia Checklist for Chinese Children and the Pupil Rating Scale Revised Screening for Learning Disabilities.

Outcome measures  The QoL for DD and healthy children was appraised by the Quality of Life Scale for Children and Adolescents (QLSCA). Outcome measures included its four domain scores (psychosocial function, physiological and mental health, living environment and satisfaction with QoL) and total score.

Results  A total of 186 children were diagnosed with DD. The distribution of DD children in five levels of QoL was statistically different from that of healthy children ($\chi^2=57.63$, $p<0.001$). Compared with healthy children, the proportion of poor or worse QoL in DD was higher, and the proportion of moderate, better or good QoL was lower. The total QLSCA score in DD children was 3.475 lower than that in healthy children ($B=-3.475$, $p=0.006$). Psychosocial function, physiological and mental health, living environment and satisfaction with QoL of DD children were also inferior to those of healthy children.

Conclusion  The QoL of DD was significantly lower than that of healthy children, prompting more public efforts to improve DD QoL.

INTRODUCTION

Developmental dyslexia (DD) is the most common type of learning disability (LD), occurring in 3.45%–12.6% of school-aged children in China.1 2 It is characterised by difficulties in word recognition, spelling and decoding in the context of adequate intelligence and educational opportunity. DD is a long-term constant defect that adversely affects the educational achievement and social adjustment throughout the life.3 Many studies have suggested that children suffering from DD have more emotional problems than their peers whose reading ability is normal.4 5 High rates of anxiety and depression persist in dyslexic children, even after controlling for comorbidity with attention deficit-hyperactivity disorder (ADHD).6–8 Anxiety and depression have been inferred to be the consequences of academic performance failure.9 These negative consequences are profound and continue into adulthood. Adults with dyslexia exhibited high levels of anxiety, which might prevent them from attending higher education.9 10 A study conducted by Moojen et al found that though majority of adults with dyslexia had received emotional support for their problems, they still exhibited more depressive symptoms and had a less favourable view of themselves than control subjects.11 In addition, DD frequently co-occurs with ADHD,12 language impairment13 and speech sound disorder.14 ADHD is recognised as one of the most common comorbidities and is simultaneously diagnosed in 13%–40% of the children with DD. Hence, it is extrapolated that the quality of life (QoL) in children with DD, which is a multidimensional measure including physiological, psychological and social functions,
may be affected to some degree. Children with LD expe-
rienced poorer QoL than typically developing children,
mainly regarding physical and psychological well-being,
relationships with family and friends, social support and
school environment.15–17 To the best of our knowledge,
there are only a few studies with small sample sizes on the
QoL of children with DD so far. Lower QoL for DD group
(127 Hungarian children) was reported in the school,
family, time spent alone, mental health domains and
general QoL than that of control group (81 Hungarian
children).18 However, the alphabetic language results
could not be directly extended to logographic language
due to cross-cultural differences. A case-control study
with 60 dyslexic children and 180 normal children
was conducted in Shantou City, China, indicating that
dyslexia significantly impacted the children’s QoL.19 The
current study aimed to expand the sample size to inves-
tigate whether the QoL of Chinese children with DD is
lower than that of healthy children in a large representa-
tive population of school-aged children.

METHODS

Participants
A cross-sectional study was conducted in December 2012.
Six primary schools were randomly selected from urban
and rural areas in Tianmen, a city in the Hubei Province,
China. All students of grades 3–6 from selected schools
were recruited. Written informed consent was obtained
from the parents or other guardians of all participants.
All participants are not suffered from visual and audi-
tory dysfunction or psychiatric diseases and have normal
intelligence according to their annual health examina-
tion. The diagnosis of dyslexic children was based on the
following criteria: (1) the score of the Dyslexia Checklist
for Chinese Children (DCCC) was 2 SD higher than the mean
value, (2) the score of Pupil Rating Scale Revised Screening
for Learning Disabilities (PRS) was lower than 65 points and
(3) the Chinese language test score was below the 10th
percentile of all children in the same grade.

Patient and public involvement
Patients or the public were not involved in the design,
or conduct, or reporting, or dissemination plans of our
research.

Data collection
Before formal investigation, the uniformly trained inves-
tigators explained the procedure and precautions in
detail to the principals and head teachers of selected
schools. The Quality of Life Scale for Children and Adoles-
cents (QLSCA) and the DCCC scale were completed by chil-
dren. The QLSCA is a self-evaluation tool for children of 7–18
years old to measure their QoL in China, with a reliability
coefficient of 0.885 (Cronbach’s α).20 It has 49 items
loading on four factors: psychosocial function, physi-
ological and mental health, living environment and satis-
faction with QoL. The psychosocial function involves the
parent–child relationship, peer relationships, teacher–student relationships, learning ability and attitude and
self-concept; physiological and mental health includes
physical feelings, negative emotion and work attitudes;
the living environment is composed of activity opportu-
nity, life convenience and athletic ability; and satisfaction
with QoL mainly reflects self-satisfaction. The score of
each item ranges from 1 to 4, and a higher score indicates
a better QoL. This scale’s nationwide norms have been
established according to the district (urban and rural
areas), gender and age. The standard T-score converted
from the original score based on specific norms was
assessed into five ranks: T<30, poor quality; 30≤T<40, worse quality; 40≤T<60, moderate quality; 60≤T<70,
better quality; and T≥70, good quality.

The DCCC has been established in 2006 based on the
definition of dyslexia in International Classification of
Diseases 10th edition, Diagnostic and Statistical Manual
of Mental Disorders 4th edition and clinical symptoms
described in relative references.21 In 2018, it has proved
to have sufficient validity and reliability (Cronbach’s
α=0.974) to screen for dyslexia among Chinese students
from grades 2 through 6 in mainland China.22 The DCCC
contains 57 items, 55 of which are loaded on eight factors
including the deficit of vocabulary comprehension, the
visual deficit of word recognition, the auditory deficit
of word recognition, the deficit of spelling, the deficit
of written expression and attention, the deficit of oral
language and bad reading habits. The remaining two
items are used to evaluate the family risk of dyslexia and
mathematics ability. The items use 5-point Likert-type
scales to assess the frequency of reading disability (never,
seldom, sometimes, often and always), and a higher score
corresponds to worse reading ability.

The PRS scale is widely adopted to screen learning
disability in children and consists of 24 items belonging to
5 factors such as listening comprehension and memory,
social behaviour, time and spatial judgments, motion
ability and language ability. The reliability coefficients
(Cronbach’s α) were higher than 0.90 for four factors
and 0.84 for one factor.23 The score of each item ranges
from 1 to 5, and a higher score indicates a better learning
ability.
A self-designed questionnaire was used, which primarily contained four parts: demographic information, home literacy environment, use of electronic devices and learning habits. Briefly, the demographic information is related to children’s age, gender, the district where the school is located, parental education and occupation, and family income. The following variables reflect the home literacy environment: frequency of parent–child reading, whether parents encourage the child to read, whether parents buy books in which the child is interested, frequency of buying new books, whether the child has scheduled time for reading, annual amount spent on books for the child and frequency of extracurricular reading. The total score of the home literacy environment summed by the above 7 variables ranges from 7 to 21. Electronic devices use is appraised by whether the child surf the internet, whether parents set scheduled time for internet surfing and watching TV, the hours spent on computers and TVs per week and the frequency of parents watching TV with the child. The total score of electronic device usage summed by the above 4 variables ranges from 4 to 11. There are three variables regarding learning habits: whether the child learns actively, whether the child has trouble finishing homework and hours spent finishing homework per day. The total score of learning habits summed by the above 3 variables ranges from 3 to 9.

**Statistical analysis**

Categorical variables were described as proportions (%) and tested with the χ² test or Fisher’s exact probability. Continuous variables were described as the mean (M)±SD and tested with a t-test. Multiple linear regression was applied to explore influential factors of QoL for children by taking 4 factors and the total QLSCA score as dependent variables and the other 11 variables as independent variables. The description of these 11 variables is shown in table 1. The method by which independent variable enters the equation is a stepwise manner. All p values were two-tailed with a significance level of 0.05. Statistical analyses were carried out by PASW Statistics V.18 software.

**RESULTS**

**Participant characteristics**

There were 5929 children from grades 3–6 in the selected schools, of which 5679 children returned their scales and questionnaires. After excluding children with visual and auditory dysfunction or psychiatric diseases or with a response rate on the scales or questionnaires of less than 90%, 5352 children were finally included in the analysis. A total of 186 children were recognised as having dyslexia, and the others were recognised as non-dyslexia.

There was a significantly higher proportion of male dyslexic children than non-dyslexic children (79.0% vs 55.5%, p<0.001). Concerning district, 128 (68.8%) children lived in urban areas for the dyslexic group compared with 3073 (59.5%) for the non-dyslexic group (p=0.011). Given the impact of the district, gender and age on QoL according to the norm in China, the distribution of dyslexic and non-dyslexic children in different age groups was stratified by district and gender. A statistical difference in the distribution was found for urban men/women, but not for rural men/women. The total score of DCCC for dyslexic children was significantly higher than that for non-dyslexic children (p<0.001). Regarding family income, there was no statistical difference between the two groups (p=0.161). The distribution of dyslexic children was statistically different from that of non-dyslexic children in terms of father’s education, mother’s education and parents’ attitude toward extracurricular activity. The scores of the home literacy environment, electronic device use and learning habits for non-dyslexic children were statistically higher than those for dyslexic children. See details in table 2.

**The comparison of QoL between dyslexic and non-dyslexic children**

The distribution of dyslexic children in five levels of QoL was significantly different from that of non-dyslexic children (poor quality: 8.6% vs 2.1%; worse quality: 19.9% vs 10.7%; moderate quality: 66.1% vs 74.0%; better quality: 5.4% vs 11.5%; good quality: 0.0% vs 1.7%; χ²=57.63, p<0.001).

Concerning rural men/women, because there was no statistical difference in the distribution of age between dyslexic and non-dyslexic children, the mean scores of the QLSCA and its four factors were compared irrespective of age. The mean scores of physiological and mental health, the satisfaction with QoL and total score for men and living environment for women in the non-dyslexic group were statistically higher than those in the dyslexic group. See details in table 3.

Regarding urban men, non-dyslexic children had statistically higher mean scores of psychosocial function, physiological and mental health, satisfaction with QoL and total score than dyslexic children in different age groups, especially in the 9-year-old and 10-year-old age groups. Regarding urban women, higher mean scores of 4 factors and total score were obtained in the 10-year-old age group. Sporadic positive results were also found in other age groups. See details in table 4.

**The influential factors of QoL for children**

The multiple linear regression model indicated a significant association between gender, age, district, group (dyslexic group and non-dyslexic group), family income of 2000–3000 CNY monthly, parents’ attitude toward extracurricular activity, home literacy environment, use of electronic devices, learning habits and total score of the QLSCA. The total score of the QLSCA for children with dyslexia was 3.475 lower than that for non-dyslexic children (B=−3.475, p=0.006). See details in table 5. Similar results were obtained for four factors of the QLSCA (data not shown).
DISCUSSION

In the present study, we compared the QoL between dyslexic and non-dyslexic groups, enriching existing research. Our results indicated that the proportion of children who had a poor or worse QoL in the dyslexic group was higher than that in the non-dyslexic group. Conversely, a lower proportion of moderate, better or good QoL was observed in the dyslexic group than in the non-dyslexic group. The total QLSCA score in the dyslexic group was 3.475 lower than that in the non-dyslexic group. Moreover, psychosocial function, physiological and mental health, living environment and satisfaction with the QoL of the dyslexic group were inferior to those of the non-dyslexic group. In addition, some demographic indicators (eg, gender, age, district and family income), parents' attitude toward extracurricular activity, home literacy environment, the use of electronic devices and learning habits affected children's QoL.

Disabilities (DD) accounts for approximately 80% of children with learning disabilities (LD). Regardless of what scales are applied, the results on LD are more consistent in different countries, indicating that children with LD experience poorer QoL than typically developing children. For instance, two studies conducted in Wuhan, China have shown that the subjective QoL scores and their dimensions among LD children were lower than those among their peers. Limited to DD, Balazs et al have found a lower QoL for DD as compared with the controls in parent reports but not in self-reports. They speculated that the low level of stigma around LDs and sponsored special education from the government for LDs in Hungary mitigated the negative consequences of DD on their QoL. However, there

| Variables | Items | Decoding of each response |
|-----------|-------|---------------------------|
| Gender    | –     | 1=male, 2=female          |
| Age       | –     | Measurement data          |
| District  | –     | 1=rural areas, 2=urban areas |
| Group     | –     | 0=non-dyslexic children, 1=dyslexic children |
| Family income | – | 1=less than 1000 CNY, 2=1000–2000 CNY, 3=2000–3000 CNY, 4=more than 3000 CNY |
| Father's education | – | 1=junior high school or below, 2=senior high school or equivalency, 3=junior college, 4=college diploma or above |
| Mother's education | – | 1=junior high school or below, 2=senior high school or equivalency, 3=junior college, 4=college diploma or above |
| Parents’ attitude to extracurricular activity | – | 1=unconcern, 2=sometimes encourage, 3=often encourage |
| Home literacy environment | | |
| The frequency of parent-child reading | | 1=occasionally, 2=sometimes, 3=often |
| The frequency of parents encourage child to read | | 1=occasionally, 2=sometimes, 3=often |
| The frequency of buy books in which child is interested | | 1=occasionally, 2=sometimes, 3=often |
| The frequency of buying new books for child | | 1=per year or buy when need, 2=per term or per month, 3=per week |
| The annual amount spent on books for child | | 1=less than 150 CNY, 2=150–500 CNY, 3=more than 500 CNY |
| Whether child has scheduled time for reading | | 1=no, 2=yes |
| The frequency of extracurricular reading for child | | 1=no, 2=everyday, 3=2–3 times per week, 4=more than 3 times per week |
| Electronic devices use | | |
| Whether child surfs the internet | | 1=yes, 2=no |
| Whether parents set scheduled time on surfing internet and watching TV | | 1=no rule or failure to follow, 2=follow rule, 3=no watching TV |
| The hours spent on computer and TV per week | | 1=less than 15 hours, 2=5–15 hours, 3=less than 5 hours |
| The frequency of parents watching TV with child | | 1=seldom, 2=sometimes, 3=always |
| Learning habits | | |
| The frequency of child learns actively | | 1=never, 2=sometimes, 3=often |
| The frequency of child has trouble in homework | | 1=always, 2=sometimes, 3=never |
| The hours on finishing homework per day | | 1=more than 2 hours, 2=1–2 hours, 3=less than 1 hour |
Table 2  Descriptive statistics of the participants

| Variable                  | Dyslexic group (N, % or M±SD) | Non-dyslexic group (N, % or M±SD) | \( \chi^2 \) or t test | P value |
|---------------------------|-------------------------------|------------------------------------|--------------------------|---------|
| Gender                    |                               |                                    |                          |         |
| Male                      | 147 (79.0)                    | 2869 (55.5)                        | 40.3                     | <0.001  |
| Female                    | 39 (21.0)                     | 2297 (44.5)                        |                          |         |
| District                  |                               |                                    |                          |         |
| Urban                     | 128 (68.8)                    | 3073 (59.5)                        | 6.51                     | 0.011   |
| Rural                     | 58 (31.2)                     | 2093 (40.5)                        |                          |         |
| Rural males               |                               |                                    |                          |         |
| <9                        | 7 (13.2)                      | 204 (17.2)                         | 6.045                    | 0.196   |
| 9-                        | 14 (26.4)                     | 259 (21.8)                         |                          |         |
| 10-                       | 11 (20.8)                     | 355 (29.9)                         |                          |         |
| 11-                       | 13 (24.5)                     | 280 (23.6)                         |                          |         |
| 12-                       | 8 (15.1)                      | 90 (7.6)                           |                          |         |
| Rural females             |                               |                                    |                          |         |
| <9                        | 2 (40.0)                      | 207 (22.9)                         | 4.971                    | 0.199   |
| 9-                        | 1 (20.0)                      | 244 (27.0)                         |                          |         |
| 10-                       | 1 (20.0)                      | 238 (26.3)                         |                          |         |
| 11-                       | 0 (0.0)                       | 185 (20.4)                         |                          |         |
| 12-                       | 1 (20.0)                      | 31 (3.4)                           |                          |         |
| Urban males               |                               |                                    |                          |         |
| <9                        | 15 (16.0)                     | 425 (25.3)                         | 12.181                   | 0.016   |
| 9-                        | 16 (17.0)                     | 424 (25.2)                         |                          |         |
| 10-                       | 32 (34.0)                     | 450 (26.8)                         |                          |         |
| 11-                       | 27 (28.7)                     | 349 (20.8)                         |                          |         |
| 12-                       | 4 (4.3)                       | 33 (2.0)                           |                          |         |
| Rural females             |                               |                                    |                          |         |
| <9                        | 2 (5.9)                       | 439 (31.5)                         | 17.189                   | 0.002   |
| 9-                        | 12 (35.3)                     | 354 (25.4)                         |                          |         |
| 10-                       | 13 (38.2)                     | 365 (26.2)                         |                          |         |
| 11-                       | 5 (14.7)                      | 220 (15.8)                         |                          |         |
| 12-                       | 2 (5.9)                       | 14 (1.0)                           |                          |         |
| Total score of DCCC      | 176.52±23.53                  | 117.00±32.68                       | -33.358                  | <0.001  |
| Family income             |                               |                                    |                          |         |
| <1000 CNY                 | 18 (10.3)                     | 387 (7.9)                          | 5.159                    | 0.161   |
| 1000–1999 CNY             | 57 (32.6)                     | 1455 (29.6)                        |                          |         |
| 2000–2999 CNY             | 64 (36.6)                     | 1710 (34.7)                        |                          |         |
| ≥3000 CNY                 | 36 (20.6)                     | 1370 (27.8)                        |                          |         |
| Father’s education        |                               |                                    |                          |         |
| Junior high school or below | 77 (43.8)                   | 1519 (30.9)                        | 25.347                   | <0.001  |
| Senior high school or equivalency | 76 (43.2)   | 2003 (40.8)                        |                          |         |
| Junior college            | 19 (10.8)                     | 849 (17.3)                         |                          |         |
| College diploma or above  | 4 (2.3)                       | 538 (11.0)                         |                          |         |
| Mother’s education        |                               |                                    |                          |         |
| Junior high school or below | 93 (52.8)                   | 1942 (39.7)                        | 14.05                    | 0.003   |
| Senior high school or equivalency | 59 (33.5)   | 1882 (38.5)                        |                          |         |

Continued
is a lack of public awareness of DD in China. Together with parents’ excessive focus on academic achievement, Chinese children with DD may be under more stress, resulting in a poorer QoL. DD was rated lower in psychological function, physiological and mental health, living environment, satisfaction with QoL and general QoL in the current study, which is broadly consistent with the Hungarian study mentioned above. Several domains (ie, school, family, mental health and general QoL) of DD children measured by another scale were reported to be worse than those of healthy children. Notably, a study conducted among Chinese children found that dyslexia group had lower scores in two factors of QLSCA (psychosocial function, physiological and mental health) than control group, but there was no statistical difference in the other factors. This is a case-control study with no difference of age, sex or residence between children with dyslexia and normal children. Correspondingly, the QoL of the two groups was not compared by the stratification of these factors, which may be the reason of inconsistent results between this study and our study.

Age and gender have generally been revealed to influence children’s QoL in past studies. Our study indicated that QoL declined with age through grades 3–6; this is partly supported by the previous finding that negative stress increases with age in elementary school pupils. During this period, academic burdens gradually increase and parent–child relationships, peer relationships and teacher–student relationships become more complex, probably leading to a lower QoL. Overall, the QoL of girls was better than that of boys in domestic studies, including ours. This is inconsistent with most foreign studies, in which the QoL of boys was superior to that of girls. We speculate that different cultural backgrounds and social expectations regarding sexes may be the reason for this inconsistency. Regarding district, urban children showed a higher QoL than rural children in the current study, most likely due to life convenience (eg, Can you

### Table 2

| Variable                                      | Dyslexic group (N, % or M±SD) | Non-dyslexic group (N, % or M±SD) | χ² or t test | P value |
|-----------------------------------------------|-------------------------------|----------------------------------|-------------|---------|
| Junior college                               | 18 (10.2)                     | 711 (14.5)                       |             |         |
| College diploma or above                     | 6 (3.4)                       | 353 (7.2)                       |             |         |
| Parents’ attitude to extracurricular activity |                               |                                  |             |         |
| Unconcern                                    | 24 (12.9)                     | 400 (7.8)                        | 7.505       | 0.023   |
| Sometimes encourage                          | 66 (35.5)                     | 1737 (33.8)                      |             |         |
| Often encourage                              | 96 (51.6)                     | 3004 (58.4)                      |             |         |
| Home literacy environment                    | 10.97±2.51                    | 12.34±2.71                       | 6.701       | <0.001  |
| Electronic devices use                       | 6.71±1.55                     | 7.04±1.38                        | 2.898       | 0.001   |
| Learning habits                              | 5.55±1.29                     | 6.74±1.30                        | 12.113      | <0.001  |

DCCC, Dyslexia Checklist for Chinese Children.

### Table 3

| Variable                                      | Dyslexic group (M±SD) | Non-dyslexic group (M±SD) | t test | P value |
|-----------------------------------------------|-----------------------|---------------------------|--------|---------|
| Males                                         |                       |                           |        |         |
| Psychosocial function                         | 58.34±10.32           | 60±9.15                   | 1.287  | 0.198   |
| Physiological and mental health               | 33.79±5.34            | 36.55±5.54                | 3.547  | <0.001  |
| Living environment                            | 20.15±3.84            | 19.55±4.24                | −1.012 | 0.312   |
| Satisfaction with QoL                         | 23.85±3.47            | 25.07±3.66                | 2.371  | 0.018   |
| Total score                                   | 136.13±16.90          | 141.17±17.33              | 2.073  | 0.038   |
| Females                                       |                       |                           |        |         |
| Psychosocial function                         | 56.60±9.07            | 62.27±8.76                | 1.443  | 0.149   |
| Physiological and mental health               | 35.00±5.48            | 37.11±4.92                | 0.958  | 0.338   |
| Living environment                            | 15.60±1.52            | 19.62±4.26                | 2.11   | 0.035   |
| Satisfaction with QoL                         | 23.00±3.00            | 25.48±3.47                | 1.593  | 0.111   |
| Total score                                   | 130.20±9.45           | 144.48±16.71              | 1.909  | 0.057   |

QoL, quality of life.
Table 4: The comparison of quality of life between dyslexic and non-dyslexic children for urban men/women

| Gender and age Group | Psychosocial function (M±SD) | Physiological and mental health (M±SD) | Living environment (M±SD) | Satisfaction with QoL (M±SD) | Total score (M±SD) |
|----------------------|-----------------------------|--------------------------------------|--------------------------|-----------------------------|-------------------|
| **Males**            |                             |                                      |                          |                             |                   |
| <9                   |                             |                                      |                          |                             |                   |
| Dyslexic group       | 57.33±7.38                 | 37.07±4.70                           | 22.27±4.32               | 24.33±3.52                 | 141.90±14.88      |
| Non-dyslexic group   | 62.00±8.51                 | 36.73±5.55                           | 21.03±4.15               | 25.14±3.62                 | 144.90±16.44      |
| t                    | 2.095                      | −0.233                               | −1.133                   | 0.846                      | 0.905             |
| P                    | 0.037                      | 0.816                                | 0.258                    | 0.398                      | 0.366             |
| Non-dyslexic group   | 58.88±6.88                 | 34.44±6.16                           | 20.13±3.79               | 23.13±3.85                 | 132.56±12.87      |
| 9-                   |                             |                                      |                          |                             |                   |
| Dyslexic group       | 63.17±8.37                 | 37.27±5.28                           | 21.16±4.10               | 25.68±3.33                 | 147.29±15.85      |
| Non-dyslexic group   |                             |                                      |                          |                             |                   |
| t                    | 3.914                      | 2.093                                | 0.997                    | 3.044                      | 3.668             |
| P                    | <0.001                     | 0.037                                | 0.319                    | 0.003                      | <0.001            |
| 10-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 57.53±8.86                 | 33.19±5.79                           | 20.03±4.91               | 23.47±3.01                 | 134.22±13.64      |
| Non-dyslexic group   | 62.23±8.60                 | 36.84±5.43                           | 21.42±4.29               | 24.96±3.50                 | 145.46±16.76      |
| t                    | 2.98                       | 3.666                                | 1.754                    | 2.352                      | 3.702             |
| P                    | 0.003                      | <0.001                               | 0.08                     | 0.019                      | <0.001            |
| 11-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 54.92±8.84                 | 33.52±4.66                           | 20.11±4.59               | 23.56±3.91                 | 132.11±16.48      |
| Non-dyslexic group   | 61.17±9.25                 | 36.64±5.49                           | 21.43±4.14               | 24.54±3.65                 | 143.78±17.44      |
| t                    | 3.393                      | 2.876                                | 1.58                     | 1.344                      | 3.363             |
| P                    | 0.001                      | 0.004                                | 0.115                    | 0.18                       | 0.003             |
| 12-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 57.25±4.19                 | 30.25±6.90                           | 22.00±5.48               | 24.00±4.76                 | 133.50±19.43      |
| Non-dyslexic group   | 58.36±7.66                 | 36.52±5.39                           | 21.45±4.21               | 25.03±3.10                 | 141.36±13.98      |
| t                    | 0.283                      | 2.137                                | −0.238                   | 0.595                      | 1.023             |
| P                    | 0.779                      | 0.04                                 | 0.813                    | 0.556                      | 0.314             |
| **Females**          |                             |                                      |                          |                             |                   |
| <9                   |                             |                                      |                          |                             |                   |
| Dyslexic group       | 58.00±1.41                 | 40.50±4.95                           | 20.00±1.41               | 26.00±1.41                 | 144.50±3.54       |
| Non-dyslexic group   | 64.24±8.31                 | 37.97±5.19                           | 21.05±4.24               | 26.16±3.43                 | 149.42±16.31      |
| t                    | 1.06                       | −0.689                               | 0.35                     | 0.067                      | 0.426             |
| P                    | 0.29                       | 0.491                                | 0.727                    | 0.947                      | 0.67              |
| 9-                   |                             |                                      |                          |                             |                   |
| Dyslexic group       | 58.25±9.73                 | 36.75±5.69                           | 19.58±6.14               | 24.92±4.08                 | 139.50±21.44      |
| Non-dyslexic group   | 64.77±8.53                 | 38.01±5.06                           | 21.71±4.22               | 25.90±3.34                 | 150.39±15.60      |
| t                    | 2.595                      | 0.845                                | 1.689                    | 0.991                      | 2.348             |
| P                    | 0.01                       | 0.398                                | 0.092                    | 0.322                      | 0.019             |
| 10-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 56.85±8.69                 | 33.00±3.05                           | 18.38±2.63               | 22.38±3.75                 | 130.62±13.35      |
| Non-dyslexic group   | 63.02±8.36                 | 36.65±5.20                           | 21.69±4.17               | 25.05±3.66                 | 146.40±16.97      |
| t                    | 2.612                      | 2.512                                | 2.837                    | 2.575                      | 3.316             |
| P                    | 0.009                      | 0.012                                | 0.005                    | 0.01                       | 0.001             |
| 11-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 55.20±7.05                 | 31.20±3.83                           | 19.60±3.85               | 25.20±2.78                 | 131.20±11.39      |
| Non-dyslexic group   | 62.34±8.24                 | 36.63±4.99                           | 21.32±3.77               | 24.52±3.72                 | 144.81±16.51      |
| t                    | 1.919                      | 2.412                                | 1.011                    | −0.405                     | 0.272             |
| P                    | 0.056                      | 0.017                                | 0.313                    | 0.686                      | 0.068             |
| 12-                  |                             |                                      |                          |                             |                   |
| Dyslexic group       | 48.00±18.39                | 23.00±0.00                           | 22.00±8.49               | 20.00±5.66                 | 113.00±32.53      |
| Non-dyslexic group   | 59.79±10.48                | 35.71±4.50                           | 21.93±5.37               | 24.00±3.55                 | 141.43±17.17      |
| t                    | 1.388                      | 3.882                                | −0.017                   | 1.414                      | 2.012             |
| P                    | 0.187                      | 0.002                                | 0.987                    | 0.179                      | 0.064             |
easily buy your living and school supplies?) and activity opportunism (eg, Do you often have opportunities to travel or watch exhibitions?). In addition, the children from middle-income households seemed to have a better QoL. When basic living needs are satisfied, the impact of adverse health outcomes caused by poverty may no longer be prominent.

The home literacy environment, electronic devices use and learning habits may influence QoL both directly and indirectly. Affluent reading resources and frequent parent–child reading can enhance the relationship between parents and children, which is beneficial for QoL. Long-term use of electronic devices has adverse effects on children’s physiology and psychology, such as increasing the risk of obesity and attention problems. On the other hand, these three factors have been significantly associated with DD risk and probably further influence children’s QoL. In addition, parents’ attitudes toward extracurricular activities such as physical exercise undoubtedly affect the frequency of their children’s participation in them. Rich extracurricular activities increase children’s communication with others and reduce negative emotions to promote QoL.

Some limitations should be considered when interpreting the current findings. First, it is a cross-sectional study; hence, the inference of a causal relationship between DD and QoL is very weak. Second, QoL is affected by various factors, many of which have not been included in our study. Third, this study was conducted in Tianmen, a small-sized city in China with a population of 1.606 million. Our results could not generalise to other cities with different characteristics. Fourth, given big sample size, Intelligence Quotient was evaluated according to annual health examination instead of the Combined Raven Test or the Wechsler Intelligence Scale for Children. The possibility that individual child with mental retardation had been included in current study could not excluded.

In conclusion, our study indicated that the QoL of DD is worse than that of healthy children, suggesting more

Table 5  Multiple linear regression of factors influencing quality of life for children (total score)

| Model                                      | Unstandardized coefficients | Standardised coefficients | t     | P value |
|--------------------------------------------|-----------------------------|---------------------------|-------|---------|
|                                            | B              | SE   | β    |       |         |       |       |
| Gender                                     | 1.705          | 0.459| 0.050| 3.711 | <0.001 |
| Age                                        | -1.166         | 0.193| -0.082| -6.054| <0.001 |
| District                                   | 1.757          | 0.506| 0.051| 3.473 | 0.001  |
| Groups (dyslexic group and non-dyslexic group) | -3.475        | 1.252| -0.037| -2.777| 0.006  |
| Family income                              |                |      |      |       |         |       |       |
| Less than 1000 CNY                         | Reference      |      |      |       |         |       |       |
| 1000–2000 CNY                              | 1.001          | 0.914| 0.027| 1.096 | 0.273  |
| 2000–3000 CNY                              | 2.977          | 0.911| 0.084| 3.269 | 0.001  |
| More than 3000 CNY                         | 1.026          | 0.939| 0.027| 1.092 | 0.275  |
| Father’s education                         |                |      |      |       |         |       |       |
| Junior high school or below                | Reference      |      |      |       |         |       |       |
| Senior high school or equivalency         | 1.012          | 0.624| 0.029| 1.623 | 0.105  |
| Junior college                            | 1.390          | 0.867| 0.031| 1.602 | 0.109  |
| College diploma or above                  | 2.021          | 1.071| 0.037| 1.887 | 0.059  |
| Mother’s education                         |                |      |      |       |         |       |       |
| Junior high school or below                | Reference      |      |      |       |         |       |       |
| Senior high school or equivalency         | 0.934          | 0.610| 0.027| 1.532 | 0.126  |
| Junior college                            | 1.031          | 0.881| 0.021| 1.170 | 0.242  |
| College diploma or above                  | 0.986          | 1.182| 0.015| 0.834 | 0.404  |
| Parents’ attitude to extracurricular activity |            |      |      |       |         |       |       |
| Unconcern                                  | Reference      |      |      |       |         |       |       |
| Sometimes encourage                        | 3.527          | 0.909| 0.098| 3.878 | <0.001 |
| Often encourage                            | 4.371          | 0.910| 0.127| 4.804 | <0.001 |
| Home literacy environment                  | 0.844          | 0.097| 0.136| 8.683 | <0.001 |
| Electronic devices use                     | 0.854          | 0.174| 0.070| 4.908 | <0.001 |
| Learning habits                            | 2.892          | 0.182| 0.225| 15.904| <0.001 |
attention and help for DD children. Additional well-designed studies are warranted to confirm our results.

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