Vocabulary diversity in personal narratives produced in response to the Global TALES protocol in Dutch-speaking students with and without dyslexia

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Short Title: Global Tales protocol and dyslexia

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Number of Tables: 5

Number of Figures: 0

Word count: 4187

Keywords: Global Tales protocol, dyslexia, reading, reading comprehension, spelling, personal narratives, assessment

Abstract

Introduction: This study examines whether there are differences in expressive vocabulary between participants with and without dyslexia in personal narratives in response to the Global TALES protocol.

Methods: 22 monolingual Dutch-speaking participants aged 11-16 with dyslexia and 22 age and gender matched peers without dyslexia were assessed on measures of decoding, reading comprehension, and spelling of words, pseudowords, verbs, and sentences. The participants also produced personal narratives in response to the six prompts contained in the Global TALES protocol. We analyzed the personal narratives for expressive vocabulary and counted the total number of different words (TNDW).

Results: The study revealed a significant relationship between TNDW and reading comprehension (r=.45, p=.002, BF_{10}=17.70), spelling words (r=.42, p=.005, BF_{10}=8.93) and spelling and writing conventions in sentences (r=.37, p=.016, BF_{10}=3.11). The Global TALES protocol was successful in eliciting personal narratives in the Dutch-speaking participants with and without dyslexia. Participants with dyslexia used fewer different words (M=192.27, SD= 64.37; 95% CI [151.84 - 232.71]) compared to peers without dyslexia (M=265.50, SD= 116.28; 95% CI [225.06-305.93]; $F(1,42)=6.68$; p=.013; $\eta^2 = .14$). When we compared the probability of models, Bayesian factors revealed moderate evidence for group differences in TNDW (BF=3.94).

Discussion/Conclusion: Our findings indicate that older school-age participants with dyslexia may lag behind their peers in expressive vocabulary in a personal narrative discourse task that is relevant to everyday functioning. The results of this study highlight the relationship between expressive vocabulary and reading comprehension and the importance of the assessment of spoken language skills in children with dyslexia. Reading problems might lead to less advanced spoken language, which in turn may negatively affect the expressive vocabulary growth in individuals with dyslexia.

Introduction

The ultimate aim of learning to read is to read for meaning: reading comprehension [1,2]. In the simple view of reading (SVR-model) reading comprehension skill equals the product of decoding (context-free word recognition) and oral language comprehension [3]. Within this model decoding difficulties can be seen as the cardinal features of dyslexia, with reading comprehension affected as a secondary trait. Several studies confirmed parts of this SVR-model [4], expanded by the direct and indirect effects of reading (DIER-model; 5] and revealing that vocabulary knowledge influenced reading comprehension through decoding [5]. Significant correlations between vocabulary and decoding (r=.43 -.46, *p*<.001) and between vocabulary and reading comprehension (r=.66, *p*<.001) have been found [4]. The ultimate aim of learning to spell is to be able to write texts. Writing, like reading, can be seen as a product of two necessary skills, transcription (spelling) and ideation (text generation). The direct and indirect effects of writing (DIEW-model) [6], expanded this view and pointed at significant correlations between expressive vocabulary and spelling (r=.46, *p*<.05) [6]. In addition, the Matthew effect pointed to a cumulative advantage for people with good skills put into situations where they can gain even more [4,7].

When children learn to read and to spell, they learn to map letters to sounds and sounds to letters. The mapping of letters to sounds and vice versa is not equally regular or predictable in all languages, which results in differences in the degree of sound-letter transparency in alphabetic languages. There is a continuum from languages with an opaque or less transparent orthography, such as English, to languages with a shallow or transparent and consistent orthography, such as Italian and Spanish. Dutch is a semi-transparent language. Approximately 5 to 11 percent of children show significant difficulties in learning to read and spell, also referred to as dyslexia [8,9]. Dyslexia refers to a neurodevelopmental disorder that is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling.

Dyslexia

In all languages orthographic transparency has a major effect [9,10,11,12] on how dyslexia is experienced. That is, dyslexia has a diversity in behavioural symptoms and a multifactorial aetiology, which can be associated with these differences. This has led to the development of competing theories about core deficits that underly the disorder. In preschool, language development, and more specifically vocabulary, seems to be related to reading and spelling skills [13]. People with dyslexia often have a history of early language delay or language impairments [8,13]. Significant differences in vocabulary skills have also been observed in university students with and without dyslexia [14]. However, until now, the relationship between vocabulary and reading and spelling skills in adolescents with and without dyslexia remains unclear [8].

Theories of reading and writing have not been able to provide a full explanation of all the symptoms. Current influential theories include the phonological deficit hypothesis, the rapid naming deficit hypothesis and the magnocellular deficit hypothesis. The phonological deficit theory [9,13,15, 16] holds that dyslexia reflects a language specific deficiency in the phonologic module. The rapid naming deficit theory points to language-processing problems with the naming of serially presented visual stimuli [15,17]. The magnocellular deficit hypothesis postulates a general temporal processing deficit that underlies reading and spelling abilities [18,19,20]. To conclude, several theories point to language related problems [8,13,14,21,22] for explaining the word-level difficulties of dyslexia. The analysis of vocabulary in narratives in a discourse task that is relevant to everyday functioning may help gain a better understanding of these linguistic aspects that are involved in dyslexia.

Narratives

Narrative language samples provide a rich source of ecologically valid linguistic data for researchers and practitioners who are interested in the study of expressive language competencies of children and adolescents [23]. At word- and sentence-level, narratives can be analyzed with regard to productivity (e.g., length of the sample or total number of words), semantic diversity (e.g., number of different words), and syntactic complexity (e.g., mean length of the communication unit) [24,25].

Narratives have also been used in previous studies with children with findings pointing to the relevance of investigating spoken language of children with reading difficulties [26]. Analysis of narrative language samples has been used to characterize the linguistic competence of a wide range of individuals including those diagnosed with developmental language disorders (DLD) [e.g., 27,28,29,30,31], with mixed results. These studies revealed that children with DLD were able to produce a cohesive, structured narrative discourse using a discourse task based on a picture book or a task where an adult listener saw or did not see a movie with the child and examining whether subjects altered their story [29,30]. In addition, children with a mixed reading disability (i.e., demonstrating difficulties in word recognition and language comprehension) were able to produce personal narratives in response to photo prompts and a fictional narrative in a story retelling context [28]. However, the children with reading difficulties showed significant difficulties in narrative ability compared to their peers without reading difficulties. Furthermore, a meta-analysis on oral narrative language measures of 37 studies between 1987 and 2019 confirmed significant narrative differences between children with and without language disorders [31].

Most of the previous research in children with DLD has thus focused on fictional narrative skills [27, 29,30] as opposed to personal narrative skills [see 31]. Personal narratives refer to children's accounts of personally experienced events, and are one of the earliest developing forms of discourse, making up more than 50% of children's daily conversations [32,33]. Children's ability to share personal narratives is important for developing social skills, mental wellbeing, classroom participation, and success in academic and vocational settings. The current study addresses this gap in research by comparing the personal narrative skills of adolescents with dyslexia to the skills of their same-age peers without dyslexia on a measure of vocabulary.

Objectives

The present study investigated whether there are differences in expressive vocabulary between adolescents with and without dyslexia in their personal narrative language samples in

response to the Global TALES protocol [34]. The study was designed to test the hypothesis, in line with the Matthew effect [7], that decoding difficulties in dyslexia lead to less exposure to advanced language, which in turn may negatively impact the expressive vocabulary growth as evidenced by lower semantic diversity (fewer Total Number of Different Words, TNDW) in the personal narratives of school-age students with dyslexia.

Bayesian factors (BF) were used to quantify evidence by the comparison of the likelihood of lower TNDW with the data under different models. A comparison of BF may provide theoretical and practical insights to improve our understanding of the links between semantic diversity and decoding, reading comprehension and spelling to help guide assessment and intervention practices.

The following Research Questions (RQ) and hypotheses guided this study:

RQ1. Is expressive vocabulary performance (TNDW) in a personal narrative discourse task significantly predicted by decoding skills, reading comprehension or spelling?

In line with the DIER-model we expected a relationship between decoding, expressive vocabulary and reading comprehension, since this model stated that vocabulary knowledge influenced reading comprehension through decoding [5]. In addition we expected in line with the significant correlations in a previous study [6], that we would find a significant relationship between expressive vocabulary and spelling.

RQ2. Do participants with and without dyslexia differ in expressive vocabulary in a discourse task that is relevant to everyday functioning? As hypothesized in RQ1, we expected lower semantic diversity (fewer Total Number of Different Words TNDW) in the personal narratives of students with dyslexia compared to their same-age peers without dyslexia.

Materials and Methods

Participants

Participants were recruited through flyers that were distributed to speech therapists, schools, parent groups and through social media. We recruited a clinically feasible sample of 16 boys and 28 girls. This sample size was similar to previous studies in this area [22] and there were no funds to recruit a larger sample. Forty-four Dutch-speaking students from mainstream schools (aged 11-16 years; M=13.23; SD=1.22) participated in the study. To be included in the group of participants with dyslexia, individuals had to demonstrate a clinical diagnosis of dyslexia, meaning, (a) having substantial (< 10^{th} percentile) difficulties with reading or spelling abilities on a standardized assessment of reading compared to those that may be expected for the individual's chronological age, and (b) demonstrating persisting reading and spelling problems despite the provision of interventions that target those difficulties. Participants from the non-dyslexia group were age and gender matched to the participants with dyslexia. The non-dyslexia group scored average or above on the standardized assessment of decoding [35] and spelling [36]. All participants came from middle-class and higher socio-economic backgrounds (based on a rating of the parental income and of the school level of the parents) and were Caucasian Dutch-speaking children.

Instruments

The study was approved by the Ethical Committee of Ghent University (BC-10460, BC-10368, BC-10369, BC-10647 and BC-10648). Written informed consent was obtained from participants and their parents to participate in the study. All tests were all completed in a quiet location, under 'examination conditions'.

All participants completed standardized tests on decoding, reading comprehension and on spelling, through instruments that were especially designed and validated for this age group. To assess decoding (decoding test [35]), individuals had to read words as quickly as possible during 90 seconds, while the researcher scored accuracy. Cronbach's alpha, as a measure of scale reliability, for decoding was .88 indicating good internal consistency. In the reading comprehension test [37] individuals had to answer 28 questions about the content of a story after reading the story silently.

Cronbach's alpha was .80 indicating good internal consistency. Participants also completed four standardized spelling accuracy tests, that covered different aspects of Dutch spelling [36]. The tests comprised a combination of 30 words that were presented in a sentence, 20 pseudowords that were at first sight similar to real Dutch words, 30 verbs in a fill-in-the-sentence task and 45 items presented in six sentences that assessed spelling categories such as writing a capital letter at the beginning of a sentence, the inflection of verbs in sentences (e.g. I say, he says, he said…), or using a hyphen in language specific written compounds (e.g. sleeping and dinner room, slaap- en eetkamer). Cronbach's α for words, pseudowords, verbs and sentences were .80, .66, .83, .83 respectively, pointing to good internal consistency for spelling words, verbs, and sentences, with acceptable internal consistency for spelling pseudowords.

Expressive vocabulary was tested in a personal narrative context using the Global TALES protocol [34,38]. [For full details and a copy of the protocol, please visit https://osf.io/ztqg6/]. Consistent with the Global TALES protocol, participants were given instructions and prompts that tapped six key emotions: excited, worried, annoyed, proud, problem situation and something important. In an attempt to avoid 'leading' the participants to create a personal story, the examiner avoided additional prompting when administering the protocol. All sessions were audio recorded and transcribed by the examiners for analysis purposes. All transcriptions were checked. The number of different words (TNDW) were calculated by hand and used as a measure of vocabulary or semantic diversity.

Statistical analyses

The first Research Question was addressed by means of Bayesian correlations and linear regressions. The second Research Question was analyzed through Multi and Univariate Analyses of Variance (M)ANOVA's with group (dyslexia, no dyslexia) as the independent variable. Bias-corrected and accelerated (BCa) lower and upper confidence intervals were computed and η^2 was calculated as effect size that focused on the strength of association in SPSS, with η^2 =.01 referring to a small effect,

η^2.=.06 referring to a medium effect and η^2 ≥.14 referring to a large effect [21]. In addition, Bayesian factor robustness checks were performed in the free and open-source statistical program 'Jeffreys's Amazing Statistics Program' (JASP) to compare models and to study the evidence for semantic diversity compared to models that used decoding, reading comprehension and spelling to distinguish individuals with and without dyslexia. Models compared were P(M), which is the probability of the model before observing the data; P(M|data), which is the probability of the model after observing the data; $BF_{M,}$ which is the Bayes Factor, comparing the posterior odds versus the prior odds of the model versus all the other models; and $BF_{10=}$, which is the evidence for H1 compared to the best model, with greater values providing stronger support in favor of H1. To interpret the findings, evidence was considered as limited with BF 1-3, which referred to the fact that the hypothesis (H1) was between 1 and 3 times more likely than H0 (null-hypothesis). If BF was 3-10 evidence was described as 'moderate'. If BF was 10-30, evidence was described as 'strong'. BF 30-100 reflected evidence that was 'very strong' and BF >100 reflected evidence that was extremely strong in factor of H1 or H0.

Results

Associations between expressive vocabulary, decoding skills, reading comprehension, and spelling. The first question asked **"**Is expressive vocabulary performance in a personal narrative discourse task significantly associated with decoding skills, reading comprehension or spelling?**" .** Table 1 describes the correlations between expressive vocabulary (the Total number of Different Words, TNDW) and decoding, reading comprehension, and spelling.

<Insert Table 1 about here>

There was strong evidence (see Table 1) for a significant relationship between expressive vocabulary (TNDW) and reading comprehension (r=.45, *p*=.002, BF_{10}=17.70). The Bayesian linear regression (see Table 2) confirmed that reading comprehension was the best predictor, as it explained 18.3% of the variance in expressive vocabulary in a personal narrative discourse task.

<Insert Table 2 about here>

There was moderate evidence (see Table 1) for a significant relationship between TNDW and accurate spelling of words (r=.42, *p*=.005, BF_{10}=8.93) and accurate spelling of sentences (r=.37, *p*=.016, BF_{10}=3.11). There was limited evidence for a significant relationship between TNDW and decoding (r=.35, *p*=.022, BF_{10}=2.39) and accurate spelling verbs (r=.36, *p*=.018, BF_{10}=2.86); the relationship between TNDW and spelling pseudowords was not significant (r=.28, p=.071, BF_{10}=0.91).

Bayesian linear regressions revealed that spelling verbs was the best predictor, as it explained 68.9% of the variance of decoding. For more information, see Table 3. The combination of expressive vocabulary (TNDW), spelling words, spelling verbs and spelling pseudowords was the best predictor for reading comprehension, as it explained 62.6% of the variance. For more information, see Table 4.

<Insert Table 3 and 4 about here>

Expressive vocabulary in a discourse task in participants with and without dyslexia

As an answer to Research Question 2 (RQ2), the ANOVA revealed significant differences with a large effect size in TNDW between participants with and without dyslexia (*F* (1,42)= 6.68; p=.013; η^2 =.14). Individuals with dyslexia used significantly fewer different words (*M*=192.27, *SD*= 64.37; 95% CI [151.84-232.71]) compared to peers without dyslexia (*M*=265.50, *SD*= 116.28; 95% CI [225.06-305.93] in the personal narrative discourse task.

Moreover, the MANOVA with group (dyslexia, no dyslexia) as independent variable and TNDW, decoding, reading comprehension, spelling of words, spelling of pseudowords, spelling of verbs and spelling of sentences as independent variables was significant at the multivariate level (*F* (7, 36)=11.67; *p*<.001; η^2 = .69). There were significant differences on the univariate level between participants with and without dyslexia on TNDW (*F* (1,42)=6.68; *p*=.013; η^2 = .14), decoding (*F* (1,42)=52.22; *p*<.001; η^2 = .55), reading comprehension (*F* (1,42)=7.45; *p*=.009; η^2 = .15), accurate spelling of words (*F* (1,42)=29.43; *p*<.001; η^2 = .41), accurate spelling of pseudowords (*F*

(1,42)=11.38; p=.002; η^2 = .21), accurate spelling of verbs (F (1,42)=49.01; p<.001; η^2 = .54) and on accurate spelling of sentences (F(1,42)=27.70; p<.001; η^2 =.39). For more information, see Table 5.

<Insert Table 5 about here>

When we compared the probability of the models for these differences between participants with and without dyslexia, Bayesian factors (BF) revealed moderate evidence for differences in TNDW (BF=3.94).

Discussion

The aims of this study were to look at the relationship between personal narrative skills, decoding, spelling, and reading comprehension and to investigate whether a personal narrative discourse task that is relevant to everyday functioning might help to gain a better understanding of the linguistic aspects that are involved in dyslexia in Dutch speaking participants. Previous studies revealed that narratives were useful to characterize the linguistic competence of children with DLD and reading difficulties, and to distinguish between clinical and non-clinical populations [25]. The present study investigated the expressive vocabulary of Dutch-speaking participants with and without dyslexia in response to six emotion-based prompts contained in the Global TALES protocol [34].

As an answer to the first research question on the relationship between expressive vocabulary (TNDW) and decoding, reading comprehension, and spelling, the hypothesis (H1) of a significant relationship between expressive vocabulary and reading comprehension was nearly eighteen times more likely than the null-hypothesis (H0). These findings are in line with previous studies [28] in confirming that vocabulary knowledge is aligned with comprehension [4]. They point to strong evidence for the relationship between the expressive vocabulary competence that is calculated through the Total Number of Different Words (TNDW) and reading comprehension proficiency. In line with what Tunmer an Chapman found when exploring the role of vocabulary in the SVR model [4], significant correlations were found between vocabulary and decoding or word recognition skills, although the evidence was considered as limited with BF < 3.

When we combined predictors, Bayesian linear regressions confirmed most evidence for a model with reading comprehension as predictor of TNDW, as it explained about 18.3% of the variance. Previous research on reading comprehension, in line with the Matthew-effect [7], also revealed that vocabulary knowledge increased over time, possibly by inferring word meanings from the context of the text, thus adding to one's vocabulary knowledge in the process of reading. Vice versa, a model that combined TNDW, spelling words, spelling verbs, and spelling pseudowords explained 62.6% of the variance in reading comprehension. This finding demonstrates the importance of vocabulary. However, it was unexpected that spelling and not decoding predicted reading comprehension [4]. Thus, the study added information on the importance of spelling, in line with previous studies (DIEW) considering spelling as an essential component of writing [6] and for decoding. Spelling verbs explained 68.9% of the variance in decoding skills.

In conclusion, in line with previous studies confirming significant correlations between vocabulary knowledge and reading comprehension [4], in the current cross-sectional study, there was evidence for a relationship between expressive vocabulary and reading comprehension. Longitudinal studies seem indicated to further elaborate on the causal connection between children's expressive vocabulary (TNDW) and reading comprehension, taking into account, in line with the DIER-model, the direct and indirect effects of decoding skills [4,5]. In addition, the hypothesis of a significant relationship between TNDW and spelling words was nearly nine times more likely than the null-hypothesis, pointing, in line with the correlations in the DIEW study, to a relationship between expressive vocabulary and 'transcription' or the proficiency to spell words.

The hypothesis of a significant relationship between TNDW and spelling sentences and verbs was nearly three times more likely than the null-hypothesis. There was only little or no evidence for a significant relationship between TNDW and decoding or spelling pseudowords. In addition, expressive vocabulary was moderately related to the accuracy of spelling words and sentences. Based on these results, it might be interesting to study interventions providing opportunities for

written expression as well as oral expression. Perhaps expanding vocabulary knowledge and simultaneously learning how to spell new words, especially in a semi-transparent language such as Dutch, could help pin those words more securely into the language users' lexical system. It might also be interesting to study interventions for children with dyslexia working on vocabulary and word structure knowledge for spelling in tandem.

As an answer to the second research question on the difference between participants with and without dyslexia, in line with theories explaining that language related problems are core deficits of dyslexia [8,13,14], Dutch speaking participants with dyslexia produced fewer different words compared to their peers without dyslexia in a personal narrative task. The hypothesis of significant differences on TNDW between individuals with and without dyslexia was nearly four times more likely than the null-hypothesis. These findings indicate that school-age participants with dyslexia may lag behind their peers in expressive vocabulary in a discourse task that is relevant to everyday functioning. The results from this study highlight the importance of the assessment of spoken language skills in individuals with reading difficulties (see also [22]).

In conclusion, findings of the current study highlight the value of the assessment of linguistic aspects that are involved in dyslexia. We demonstrated there was strong evidence for differences in expressive vocabulary (semantic diversity) between individuals with and without dyslexia aged between 11 and 16, in personal narrative performance in response to the global TALES protocol.

Limitations and future directions

All studies have limitations. In this study, one limitation is the small sample size of participants. Additional research, recruiting a larger, more diverse sample of participants is needed to confirm our results. We cannot be certain that our findings are generalizable to children speaking languages other than Dutch, considering the reported differences among languages [10,11,12]. Another limitation is that we only analyzed, in line with earlier studies, the narrative microstructure. The number of different words was used to study the semantic diversity in the children's personal

narratives. Other information such as syntactic complexity (e.g., mean length of the communication unit) and narrative macrostructure (e.g., coherence) might give additional information [23]. In addition we did not assess listening comprehension [4,5], nor writing [6], nor the number of books that participants read, nor the amount of listening to audiobooks, nor their autonomous motivation to read. Additional studies seem indicated to compare a model including this information. Finally a limitation of the current study is the fact that this was not a longitudinal study, so we cannot draw cause-effect conclusions [6]. We advice caution in attributing causal relationships to the Matthew Effect Hypothesis [7], with increasing vocabulary gaps as children with dyslexia get older and read less than there typically developing peers, which has not always been confirmed [39].

Future longitudinal research should address these issues and should examine bidirectional relations [5]. To better understand the locus of failure, in future research a personal narrative task, decoding, reading comprehension and spelling skills should be assessed and targeted in instruction. Individuals with dyslexia may be weak in oral language skills (including vocabulary), decoding, reading comprehension, spelling, or in two or more of these skills. Further assessments can be conducted to find out sources of their difficulties and provide targeted instruction based on the profiles of strengths and weaknesses. In addition, it might be interesting to study if vocabulary delay can be diminished by parents and educators reading stories to preschool children at risk for dyslexia. Listening to stories, preschoolers are introduced to broader and more difficult vocabulary, creating opportunities to infer the meaning of words from the context. It might also be interesting to study if reading software and audio books might enhance the comprehension and use of more complex vocabulary. As children become better readers, they are expected to read more complex texts and books and to infer the meaning of new complex words from the context.

Conclusion

Together with previous studies, the findings from this small-scale investigation demonstrated the relationship between the total number of different words (TNDW) in a discourse task that is relevant to everyday functioning and reading proficiency. In addition, our findings revealed that Dutch-speaking 11- to 16-year-old participants with dyslexia may lag behind their peers in vocabulary diversity when sharing personal narratives in everyday communicative situations. This stresses the importance of the assessment of spoken language skills in dyslexia, for example through the use of the Global TALES protocol.

Statements

Statement of Ethics

The study was reviewed and approved by the Ethical Committee of Ghent University (BC-10460, BC-10368, BC-10369, BC-10647 and BC-10648). Written informed consent was obtained from the participants' parents and from the participants themselves to participate in the study.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

There was no funding relevant to their study.

Author Contributions

The first author, Christel Van Vreckem, is the corresponding author.

Christel Van Vreckem, Artevelde University of Applied Sciences, Department of Speech and Language therapy, Voetweg 66, 9000 Ghent, Belgium, tel. 0032496056355. She designed and set up the study to test oral language with the GLOBAL TALES protocol. She made substantial contributions to the selection of instruments and to the interpretation of the data. The second author, Annemie Desoete, checked the data and approved the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. She collected some additional data and revised the work critically for important intellectual content and approved the version to be published. The third (Delfine Simoens), fourth (Aveline Van de Vyver), fifth (Jana Pauwels) and sixth authors (Charlotte Van Laethem) authors tested participants and interpreted the data. The last author (Kristiane Van Lierde) made substantial contributions to the conception and design of the work as well as to the analysis and interpretation of the data. All authors contributed to this paper substantially.

Data Availability Statement

The data are stored at Artevelde university of applied sciences. Data and materials support the published claims and comply with field standards.

The data are not publicly available on ethical grounds. All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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