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Oral health information in the Science, Tamil, and English samacheer textbooks of upper primary and secondary schools in Tamilnadu – A content analysis

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ARTICLE INFO

Article history:
Available online 1 June 2017

Keywords:
Oral health
School
Textbooks
Health education

ABSTRACT

Background: Health education through school textbooks is effective in promoting knowledge, reforming, and improving health related behaviors among children. The study evaluated the amount of oral health information, readability and quality of contents in upper primary and secondary school samacheer textbooks, Tamilnadu.

Methods: Content analysis for the text books of 6 to 10th standard tamil medium samacheer syllabus were analysed by three examiners on the major health topics covered under Science, English and Tamil subjects. The contents were also assessed for the simplicity of the language using Flesch- Readability Ease (RE) Index.

Results: The results showed that the amount of oral health information given in the Science textbook was more than English and Tamil. In science, more amount of contents were found in the 9th standard textbooks, under the topic Tobacco and Oral diseases than others. The information was accurate (100%) mostly in the form of text (60.8%); they were very hard to understand (RE Score=14.03).

Conclusions: The potential of secondary school textbooks in delivering oral health messages is very little in samacheer school textbooks. Considering the critical importance of school students' age into account, incorporating health information in textbooks should be more strongly emphasized.

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1. Introduction

Dental caries and gingivitis are the two major burden of oral diseases among children globally. In India, the overall prevalence of dental caries and gingivitis among children and adolescents was found to be as high as 63.20% and 57.01%, respectively.[1,2] Children are thus, considered to be under a high-risk group for developing various oral diseases, due to their improper food habits, poor oral hygiene maintenance, and changing lifestyle, day-by-day. Hence, educating children about the proper oral hygiene becomes the need of the hour. Promoting health among children through health education

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http://dx.doi.org/10.1016/j.jpfa.2017.03.004

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empowers them to have a control over their oral health thereby improving it. Health education can be provided to children by various methods. The United Nations Children's Fund (UNICEF) considers schools as the widest world channel for broadcasting information to the school children and their families. It is evident that the most influential stages of children's development are the school days during which they attain lifelong beliefs, attitudes, and skills.[3] Among the various health education methods in schools, school textbooks play an essential role. They act as primary tools for promoting knowledge, reforming, and improving health-related beliefs and behaviors among the children more economically. There are many health promoting schools (HPS) which aim at delivering health education to the children through the school curricula and other activities. Health education has been taught as a specific subject or as a part of other subjects. Nevertheless, through this method, the researchers have provided substantial evidence in the improvement of the children's general and oral health in India and around the globe.[4,5] In Tamilnadu, 60% of the children are enrolled under a uniform system of education called Samacheer Kalvi (TamilNadu Uniform System of School Education) introduced by the Tamilnadu State board Education System in 2010. Providing health education through this method can create a great impact on a larger sector of children in Tamilnadu. Regular revisions of the contents of the samacheer textbooks are being conducted every year by the School Educational Department, Tamilnadu. However, analysis of the quality of contents by them is still a question of doubt. In an Indian scenario, though many studies have analyzed the contents on general health topics, studies evaluating the contents on oral health in school textbooks were found to be very scanty. Literature search suggests hardly any evidence in the analysis of contents of oral health-related information among the samacheer school textbooks. The study evaluates the amount of oral health information based on the accuracy and simplicity of the contents in the upper primary and secondary school textbooks of Tamilnadu.

2. Materials and methods

The textbooks of Tamil Nadu state board Tamil medium samacheer syllabus for the academic year 2014–2015 was downloaded from the official website of the Department of School Education, Government of Tamil Nadu (www.textbooksonline_tn.nic.in) and authenticated by the Headmistress of a Government school. The study was carried out for a period of 4 months (June-September 2016). 27 textbooks with 4135 pages from 6th to the 10th standard were selected on the following subjects: Science, Tamil, and English. Each of the textbooks was reviewed by 3 Dental Professionals for its content on oral health. The inter-examiner reliability was found to be good (97.2% agreement). The content analysis of the subjects was conducted based on: (1) content on core components; (2) mode of representation of the contents; (3) accuracy of Information given in the contents; (4) simplicity and ease of the language.

2.1. Content on core components

They were assessed by all the 3 Dental Examiners based on 5 core components coded as Component 1 – Anatomy, morphology, and functions of the tooth and other structure related to oral and maxillofacial region under the keywords: incisors, canine, premolar, molar, number of teeth, maxilla, mandible, facial bone, function of teeth (or) other oro-facial structures; Component 2 – Nutrition and diet relating to oral health and disease under the keywords: micro & macro nutrients, fruits and vegetables (antioxidants) good for oral health, sugar and acid containing food substances; Component 3 – Tobacco and its forms, components, consequences, and prevention under the keywords: chewing tobacco, cigar, cigarettes, dipping tobacco, pipe tobacco, snuff and other forms tobacco, tar, nicotine, oral, lung, head and neck cancers, tobacco cessation program, counseling; Component 4 – Oral Health – Disease and Prevention under the keywords: dental caries, gingival and periodontal diseases, dental trauma, tooth wear, dry mouth, tooth sensitivity, halitosis, mouth ulcer, brushing (or) other oral hygiene aid, mouth mask, hand wash technique, sportswear, helmets; Component 5 – Other contents relating to oral & maxillofacial region unspecified under the above categories. Keywords under each core component were distributed to all the examiners. The frequency of contents in every core component was determined based on the number of times the keywords appeared in each component, for every page. It was numbered once, if any of the keywords under the components, appeared in a paragraph and the frequency increased as the keywords appeared in the subsequent paragraphs of that particular page.

2.2. Mode of representation

They were categorized into 1 – Texts; 2 – Pictures; 3 – Pictures supported by texts; Their frequency under each category were enumerated for every page by all the 3 dental examiners.

2.3. Accuracy of information

The accuracy of contents given about oral health were dichotomized into 1 – Accurate; 2 – Inaccurate information by the principal investigator.

2.4. Simplicity and ease of the language

The simplicity and ease of the language in the contents were assessed by the Flesch Reliability Ease Index (1948) using the formula:

$$R.E = 206.835 - (1.015 \times ASL) - (84.6 \times ASW)$$

ASL: average sentence length: no. of words/no of sentences; ASW: average syllables per words: no of syllables/no. of words. Scores between 100 – 79 denotes that the contents are easily read understood by children; 60–69 denotes a standard level of reading; 50 – 0 denotes a difficultly in reading the contents among children.

Table 1 – Distribution of the components among the classes 6–10 for Science, Tamil and English textbooks.

Subject	Component	6th	7th	8th	9th	10th	Total	Significance
Science	Component 1	2	15	7	21	2	46 (43.8%)	.000
	Component 2	1	0	0	0	0	1 (1.0%)	
	Component 3	2	0	5	28	0	35 (33.3%)	
	Component 4	4	0	3	2	3	12 (11.4%)	
	Component 5	1	0	2	0	8	11 (10.5%)	
	Total	9 (8.6%)	15 (14.3%)	17 (16.2%)	51 (48.6%)	13 (12.4%)	105 (100%)	
Tamil	Component 1	0	0	1	17	1	19 (54.3%)	.000
	Component 2	0	0	0	2	0	2 (5.7%)	
	Component 3	0	0	0	1	7	8 (22.8%)	
	Component 4	1	0	0	2	0	3 (8.6%)	
	Component 5	0	0	0	0	3	3 (8.6%)	
	Total	1 (2.9%)	0	1 (2.9%)	22 (62.8%)	11 (31.4%)	35 (100%)	
English	Component 1	0	1	0	0	0	1 (7.7%)	0.003
	Component 2	0	0	0	0	0	0	
	Component 3	0	0	0	0	0	0	
	Component 4	0	1	0	11	0	12 (92.3%)	
	Component 5	0	0	0	0	0	0	
	Total	0	2 (15.4%)	0	11 (68.87%)	0	13 (100%)	

2.5. *Data analysis*

The data were entered into the Microsoft Office Excel 2007. Qualitative and quantitative analysis of the contents were carried out using Descriptive Statistics (SPSS software version 16). Inferential statistics using Chi-square was performed to assess the statistical difference among all the standards. Statistical significance was set at $P < .05$.

3. Results

Among the 4135 pages of the 27 secondary school textbooks, the total number of information related oral health that appeared in the form of both texts and pictures was 153. Among the different standards, the occurrence of oral health related contents was highest in science (105) followed by Tamil (35) and English (13) textbooks.

3.1. *Core components*

The distribution of contents across each core component ranged widely (Table 1). Most of the information were on component 1 which accounted to 46 (43.87%) among the science subjects and 19 (54.3%) among the Tamil subject. The contents in the English textbook were largely on component 4 which accounted to 12 (92.3%). Across the standards, majority of the core components appeared in the 9th standard textbooks (84). The distribution of codes among all the 5 standards was significantly different for science (*P* .00) Tamil (*P* .00) and English (*P* .003) textbooks. The textbooks of standard 6th, 8th, 10th and textbooks of standard 7th contained No information on oral health.

3.2. *Modes of representation*

The oral health Information was largely presented textually to the children. Among the science textbooks, 70.5% of the contents were textually represented and 29.5% were explained in the form of pictures supported with text. Majority of the contents in the Tamil textbooks were based on texts (97.2%) with very little contents (2.8%) illustrated by pictures associated with the texts. 81.27% of the information in English textbooks were textual unsupported by any pictorial representations. Across the classes, 9th standard shared more information in the form of both texts and pictures associated with texts.

3.3. *Accuracy of contents*

The accuracy of information accounted for 99% among science, 100.0% among English and 94.4% among Tamil textbooks. There was a statistical difference in the distribution of accuracy of contents among the various standards in English (*P* .003) and Tamil (*P* .001).

3.4. *Readability Ease Scores*

The contents in Science textbooks among 8th standard shared scores as low as 10.69 (SD = 7.20). In Tamil text books, 10th standard accounted for a lower score of 30.47 (SD = 21.85) when compared to the others. The English textbooks were found easier to understand with a maximum score of 84.33 (SD = 8.38) among the 9th standard. The R.E scores suggested that the English textbooks of the 9th standard could be easily understood by children and the science textbooks of 8th standard were complicated to understand by the children of that particular age (Table 2).

4. Discussion

Early oral health education to school age children changes their attitude, beliefs and behavior thereby leading to healthy oral practices among them. There is a greater influence of psychological factors such as motivation and readiness to take

Table 2 – Distribution of mean of the Flesch Readability Ease (RE) scores among the classes 6–10 for Science, Tamil, and English subjects.

Subject	Class	mean RE score	Standard deviation	Level of ease
Science	6	11.12	11.43	Very hard
	7	10.73	10.46	Very hard
	8	10.69	7.20	Very hard
	9	14.03	10.67	Very hard
	10	16.69	12.16	Very hard
Tamil	6	31.24	0	Hard
	7	0	0	...
	8	48.80	0	Hard
	9	34.25	23.98	Hard
	10	30.47	21.85	Hard
English	6	0	0	...
	7	52.44	65.4	Standard
	8	0	0	...
	9	84.33	8.38	Easy
	10	0	0	...

on challenges and practices among children in their early adolescence.[6] In Tamil Nadu State Board Education system, upper primary level comprises of the standard 6–8th and Secondary level include 9 and 10 standard. The net enrolment rate of middle school children has increased to 99.10% and 96.06% among secondary school children in 2014–2015. Also, 5,806,000 (60%) students in the state were enrolled under the Tamil Medium of Education. Hence, presenting oral health information to children under Tamil medium samacheer syllabus will benefit a larger proportion of children (School education department, Government of Tamilnadu, 2016). With extensive literature search and considering the fact that, the science, English and the Tamil textbooks carry greater health messages than the social science and mathematics textbooks, the former subjects were only included in the study. The results suggested that, out of the 4135 pages of the 27 school textbooks, only 153 oral health-related contents were present. A similar study by Kazemain et al. comprised of 210 health messages including oral health among all five standards of the primary school.[7] The relatively small amount of oral health information is not adequate enough for shaping the attitudes of children towards healthy oral hygiene practices. Component 1 – anatomy and morphology and functions of the tooth and other oral and maxillofacial region contributed to a greater extent in the textbooks. Benchmarks for Science Literacy – A Project 2061 statement published by Oxford University Press proposed a curriculum for American children of grades K-8 and high school biology which emphasizes the importance of human anatomy and functions that include organization of the body; protection, support and movement; providing internal coordination and regulation; processing and transporting; and growth and development in the school textbooks. Teaching primary school children about their anatomy and physiology can help them with self-care and self-understanding leading to a greater compliance with health care regimens. There was a dearth of information on Component 2 – nutrition and diet. Document 4 of the WHO Information Series on School Health emphasizes food and nutrition as central to health promotion by showing how food and nutrition in the curriculum can strengthen health promotion activities in schools.[8] A Systematic review by Marino et al. suggest that 3 out of 14 studies from 1980 to 2009 that focused on the content analysis of nutrition and diet among school textbooks, had over-representation of sugar rich food creating a negative impact on the children's healthy eating behavior.[9] D'Onofrio et al. suggest that in American elementary textbooks, cake alone accounted for one in every 12 food appearances while fruits, vegetables, and other food groups accounted for 15% or less of all food words.[10]

The WHO has laid down certain guidelines on the 'tobacco use prevention' in school textbooks. However, there was a lack of information on Component 3 – tobacco – its forms, consequences, and prevention. A study across multiple developing countries contained a limited number of school textbooks (8.6% of the 474 textbooks) describing the consequences and prevention of tobacco use.[11] Studies suggest that 36% of children start smoking at the age of 5–10 years and 64% by the age of 10–12 years in India.[12] Education about the risks of smoking and tobacco use can bring a great change in this prevailing trend among these children. Also, WHO in one of its information series on school health[13] specifies certain educational goals for oral health education curriculum of school children which emphasize on dental plaque, healthy foods, and demonstration of a positive attitude towards oral health and importance of teeth. Textbooks have, to some extent, convinced to cover these WHO specified goals. However, the amount of information on Component 4 – Oral Disease and Prevention was relatively lesser (9.5%). Kim et al. suggest as low as 6.5% and 2.1% of health information among middle and high school children in Korea.[14] In Tamilnadu, basic information on parts and type of teeth, tooth decay, and brushing were present in the textbooks of all the three boards (State board, Matriculation, and CBSE).[5] However, a study by Priya et al. report a low level of oral health knowledge, attitude, and practice among 10–16 year school children in Chennai.[15] The reason may be lacunae in the awareness among children regarding oral health, diseases, and the oral hygiene practices. Incorporating sufficient contents on oral health can reduce the severity of many oral diseases among them. Apart from these 4 core components other oral health related messages like the components of toothpaste, tooth structures of animals were also present in the textbooks.

In the study, most of the information on oral health were presented in the form of text than the pictorial representation. Images and diagrams are usually associated with improved learning among children.[16] The textbook of higher standard children has more detailed text than that of lower standards which shared more picture and illustrations. A study on health education in primary school textbooks in Iran contains 46% of the messages as pictures and the remaining 54% as text and the number of visual messages decreased gradually from the first grade to the fifth standard which was also justified in this study.[7] The syllabus related information, revision of all these textbooks were usually determined by the Secretary of School Education along with Director of School Education, the Directorate of Teacher Education, Research, and Training (DTERT) and eminent Educationalists. Once, approved, the textbooks are then printed by the Tamilnadu textbook co-operation. Hence the quality of contents was remarkably good in the study. The majority of the information were accurate. This was contradictory to a systematic review on the content analysis of health topics in school textbooks where 13 out of 14 studies indicated revision of the contents and also school textbooks in developing countries need to improve the quality of contents related to health information.[9]

A Readability Index decides the effectiveness of any printed material. There are different formulae to measure the readability ease of different languages. The Flesch Readability Ease Index (1948) was used to in the study. The oral health contents of all the standards came under the 'very hard' category of the Flesch Readability Ease Index for Science and Tamil subjects. The English textbooks were comparatively 'Easier' to understand. This could be due to the variation in the number of words syllables in the English and Tamil languages. Balarubini et al. analyzed that the Flesch Readability Ease Scores of the contents in the news published about Tamil Nadu Agriculture University in English (12.31) and Tamil dailies (13.33), were very hard to read and understand.[17] In the readability formulae, word difficulty and sentence length were identified as major determinants of text readability. Words difficulty was determined by more number of syllables in a word. Sentence length was measured by the number of words in a sentence. The study confirms that the low level of the contents Readability Ease scores makes it difficult for children to understand. Hence simpler sentences have to be employed for a better reading ease. A similar study on the Readability of Science lesson of junior high schools suggested that readability of science student's book for the VIII standard was low (24) which led to a low intrinsic motivation to read among them.[18]

4.1. *Limitations*

The major limitation of the study was the exclusion of the social science and mathematics textbooks due to its limited potential towards bearing oral health information. However, overlooked contents among these them (if any) can affect the results of the study. Also, the Flesch Readability Index was conducted based on previous literature studies. The low values of the scores could be due to the difference in the words, sentences and syllables of Tamil when compared to the English textbooks.

5. Conclusions

It is very concerning that, despite framing guidelines by WHO for delivering oral health information in school textbooks, many areas have been left uncovered. The study calls for improving the quantity of oral health-related information in the school textbooks of children from 6th to 10th standard.

5.1. *Recommendations*

There is always a high potential for promoting oral health information among children, through school textbooks. The study recommends the need of incorporating more information on oral health at Upper primary and secondary school samacheer textbooks in Tamilnadu. It is recommended that the textbooks should follow:

1. The Guidelines by the WHO, Information series on School health in including the contents relating to nutrition and diet, tobacco and its consequence and prevention[19] and oral health related information in the school textbooks and also, increasing the quantity of such information.
2. Incorporation of more pictorial illustration of the contents which can have a direct positive impact in the behavioral practices among the children.

Addressing those needs and recommendations shall improve the oral health of school children and as a result reduce the prevalence of the dental caries and gingivitis, which are the 2 major oral disease burden among them.

Conflicts of interest

The authors have none to declare.

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