

Examination of Reviews-Outcomes of Community Water Fluoridation in Dental Caries Prevention

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Abstract

The purpose of this paper is to examine the different reviews of the outcomes of fluoridation of community water in the prevention of dental caries in Cochrane library. The earlier articles within the period, 2010 and 2013, were introduced in this study. As dental caries has remained a challenge in public health where the quantity of fluoride in water is low (lower than the recommendation of World Health Organization 1 part per million (ppm)). The positive effects of fluoridation of community water in the prevention of dental caries are recognized in a widely manner, especially in the consideration of children. In some selected reviews, it was discovered that fluoride is effective in the prevention of dental caries in people whose ages are more than 20 years. There is a relationship between the concentration of water fluoridation of quantity higher than 1 ppm and the incidence of dental fluorosis. It was also observed that there is no relationship between fluoridation and cancer or bone fracture, or any other effects. As fluoridation of water is of immense benefit to a community with higher population, the authors and researchers also acknowledged and recommended other sources of fluoride such as milk, salts, and tooth paste, for prevention.

Keywords: fluoride, dental caries, cancer, water fluoridation, community water, oral diseases.

1.0 Background of the study

The main pathway of the human body system through drinking, eating, and speaking is the mouth. According to [7], an integral aspect of the total well-being of any individual is the oral health. The moment the oral health of a person is good, such individual will effectively communicate and consume any type of food, and able to live a quality lifestyle, social confidence and self-esteem [17]. Watt further expatiated that when oral diseases such as periodontal diseases, dental caries, dental erosion, and oral cancers, could hinder the individual from a

happy lifestyle. These diseases have affected a notable portion of the world's population, in terms of mortality and morbidity. There is a high prevalence of oral diseases; hence the negative impact on the society is noticeable. Some of impacts of these diseases include discomfort, pain, sleeplessness, inability to eat effectively and absenteeism from work or school [17].

There have been remarkable effects on nutrition in developing countries due to changes in political, economic and social aspects, thus shifting the people from consuming local and traditional foods to diets of Western countries [15]. According

to [14], one of the major health challenges in almost all industrialized countries is dental caries. According to [15], the number of children in school is within the range of 60 and 90%, and high proportion of adults is involved. Petersen & Lennon further stated that dental caries is caused by high rate of sugar consumption and lack of adequate exposure to fluoride.

The disease, dental caries, is preventable [14], and this can be controlled when there is synergy between health professionals and individuals by adopting methods that will help in the reduction of sugar consumption and the creation of awareness on the benefits of fluorides. Fluoridation of community water is aimed at reaching the larger population. According to [1], more than 144 million people have access to drinking water that belongs to the community. A study titled "community effectiveness of public water fluoridation in reducing children's dental disease" was conducted by [2]. The study compared children's decay experience and prevalence between areas with and without water fluoridation in Australia. The outcome of the study was that all the categories of the children had higher cases of dental caries.

Fluorine has been used in the prevention of cavities when observed with people that grew up drinking water that contained fluoride, and as such had minimal cases of cavities [7]. Studies on effect of fluoride on oral health commenced over 100 years ago, but 50 years earlier, the studies focused on the relationship between water-borne fluoride, dental caries, and fluorosis [15]. Sequel to this was the focus on the evaluation and development of fluoride rinses, toothpaste, milk, and salt [15]. Notable articles have been printed on the outcome-effects of the use of fluoride on humans, and an inquiry into the database has shown proofs on the subject. The UK University of York Centre for Review and Dissemination conducted some systemic reviews on water fluoridation in the specialized areas of fluoride ingestion,

fluoride toothpastes and fluoride rinses using the Cochrane Collaboration Oral Health Group. The summary is as follows:

- 1) There is a reduction of the frequency of dental caries through the use of water fluoridation by 15% (2.2DMFT).
- 2) Toothpastes with fluoride and mouthwash rinses cause a reduction of DMFS 3-year increment by 24 to 26%.
- 3) There is no reliable evidence of the adverse effect of water fluoridation.
- 4) There is a level of concentration where there is a relationship between water fluoridation and dental fluorosis.
- 5) There was no evidence of a research into the adverse effect of the use of fluoride toothpaste and mouth wash rinses.

The benefits of water fluoridation are acceptable in developing countries as explained by [9]. This complements the review of the success of water fluoridation in United States of America because there are other methods of the provision of fluoride and the availability of the products that contain fluoride which reduces the prevalence of dental caries.

2.0 Objective

The objective of this paper is the evaluation of the effectiveness of fluoridation of community water in the reduction of dental caries disease. In achieving this, review of related literatures in Cochrane review will be done.

2.1 Selection Criteria

- 1) *Types of Studies*: The studies conducted by using the non-randomized control trials, case or cohort control studies were well-researched. The report was well written in the language of communication, English language.
- 2) *Types Participants*: The participants were school children that profited from the water fluoridation intervention program.
- 3) *Types of Intervention*: these are distinct programs on water fluoridation

targeted at the prevention of dental caries executed at the community. All the participating children were visited in their homes, schools, and through the health workers in their various communities.

- 4) **Types of Outcome Measures:** the children that attended the screening program of the oral health judged the outcome of the status of the oral health.

2.3 Search Strategy for Identification of Studies

In the course of this study, relevant literatures on fluoridation of water and prevention of dental caries were reviewed using Cochrane Database of Systemic Review, PUBMED, MEDLINE, CINAHL and Google Scholar. Though some relevant materials were retrieved from Cochrane Library, but most of the works cited were from other sources.

3.0 Methods of Review

The articles selected were based on the key terms related to the seminar topic. A related article was retrieved from the Cochrane Library, but other materials received through Google Scholar were relevant to the study. All the materials are from the search criteria, “water fluoridation”, and they were within the period 2010 and 2013. Quantitative approach methodology was adopted by these studies.

3.1 Description of Studies

From the ten articles found from the database and through Google Scholar, all are related to water fluoridation. These research papers discussed the prevention of dental caries using fluoridation. The participants in all the studies were children of different age categories. Results from other relevant papers were also presented by most of the articles reviewed. In these articles, some of the authors stated to have reviewed similar studies of over 20 articles.

Methodological Quality of Included Studies

The studies were well-conducted and utilized standard methodology. All these studies had abstract except one that is a protocol for review. Furthermore, each of the articles had objectives of the study, background, method, results and discussion section, conclusion, and the references.

4.0 Results

In the study conducted by [2], the result showed that Children from every age group had greater caries prevalence and more caries experience in areas with negligible fluoride concentrations in the water (<0.3 parts per million [ppm]) than in optimally fluoridated areas (> or = 0.7 ppm). Controlling for child age, residential location, and SES, deciduous and permanent caries experience was 28.7% and 31.6% higher, respectively, in low-fluoride areas compared with optimally fluoridated areas. The odds ratios for higher caries prevalence in areas with negligible fluoride compared with optimal fluoride were 1.34 (95% confidence interval [CI] 1.29, 1.39) and 1.24 (95% CI 1.21, 1.28) in the deciduous and permanent dentitions, respectively. The study conducted by [3] revealed that children who brushed their teeth less often and were older, male, of low SES, from rural or remote areas consumed significantly more SSBs. Caries was significantly associated with greater SSB consumption after controlling for potential confounders. Finally, greater exposure to fluoridated water significantly reduced the association between children's SSB consumption and dental caries.

According to the result presented by [5], the review describes the main sources of fluoride intake that have been identified: fluoridated drinking water, fluoride toothpaste, dietary fluoride supplements and infant formulas. Recommendations on how to avoid excessive fluoride intake

from these sources are also given. The result, according to [6] showed that no study evaluated effects of screening by primary care providers on clinical outcomes. One good-quality cohort study found paediatrician examination associated with a sensitivity of 0.76 for identifying a child with cavities. No new trials evaluated oral fluoride supplementation. Three new randomized trials were consistent with previous studies in finding fluoride varnish more effectively than no varnish (reduction in caries increment 18% to 59%). Three trials of xylitol were inconclusive regarding effects on caries. New observational studies were consistent with previous evidence showing an association between early childhood fluoride use and enamel fluorosis. Evidence on the accuracy of risk prediction instruments in primary care settings is not available.

[8] Commented that the prevalence of fluorosis (TFI ≥ 1) in communities with 0.70 and 1.50 ppm water fluoride was 39.4 and 60.5% ($p = 0.014$), respectively, while the prevalence of more severe forms (TFI ≥ 4) was 7.9 and 25.5% ($p < 0.001$), respectively. The mean D3MFT was 0.49 (± 1.01) in the 0.70 ppm community and 0.61 (± 1.47) in the 1.50 ppm community ($p = 0.349$). A logistic regression model for caries (D3 > 1) showed that higher fluorosis categories (TFI 5-6 OR = 6.81, $p = 0.001$) were associated with higher caries experience, adjusted by age, number of teeth present, tooth brushing frequency, bottled water use, and natural water fluoride concentration. [10] found that one hundred and ninety children (mean age: 36.3 ± 6.9 months) were recruited from six community medical clinics. Ninety-two children (48.4%) were caries active. The mean d(123) t and d(123) s scores were 2.2 ± 3.3 and 3.0 ± 5.6 , respectively. Higher plaque scores were significantly ($P < 0.0005$) associated with all measures of decay (presence of decay, dt, ds).

The risk factors for severity of decay (i.e., dt and ds) include child's age,

breastfeeding duration, and parents' ability to withhold cariogenic snacks from their child. According to [11], the objectives of the study are two-fold: to evaluate the effects of water fluoridation (artificial or natural) for the prevention of dental caries; and to evaluate the effects of water fluoridation (artificial or natural) on dental fluorosis. In measuring the percentage prevalence of fluorosis, all children with fluorosis according to the index used will be classified as 'fluorosed' as opposed to normal. As measured by the common epidemiologic indices for dental fluorosis [18], children with a DDE, TSIF, TFI score greater than zero or Dean's classification of 'questionable' or higher will be classified as fluorosed. If the other indices are used, the percentage prevalence of fluorosis as reported by the original investigators using other methods (e.g. photographic method or other index) will be considered and adopted. Any fluorosed teeth scored ≥ 3 (TFI), ≥ 2 (TSIF) and 'mild' or worse (Dean's) will be considered to be of aesthetic concern. Analysis on dental fluorosis of aesthetic concern will be restricted to TFI, TSIF and Dean's indices as it is not easily determined from the modified DDE index.

In the report of [12], fluoride concentration in drinking water varied considerably within the country from very low (< 0.10 mg/l) to more than 1.5 mg/l. Only little variation was found over the 10-year study period. Dental caries in both 5-year-olds and 15-year-olds decreased over the study period. An inverse relation between the risk of dental caries and fluoride concentration in drinking water was found in both primary and permanent teeth. The risk was reduced by approximately 20% already at the lowest level of fluoride exposure (0.125-0.25mg/l). At the highest level of fluoride exposure (> 1 mg/l), a reduction of approximately 50% was found. Similar findings were found if analysis was limited to children residing in the same place during the entire study period.

[16] reported that at baseline, 666 children were examined; 543 of them (82%) were re-examined 2 years later. The adjusted dmfs increment was significantly lower in the intervention group compared to the control group by an average of 3.0 surfaces per child (95% CI = 1.2, 4.9), a prevented fraction of 31%. Adjustment for additional variables yielded caries reductions ranging from 2.3 to 3.5 surfaces per child and prevented fractions of 24-36%.

5.0 Discussion

The studies reviewed discovered that fluoridation of water can remarkably reduce the prevalence of dental caries in children as well as in adults' population, and decrease the mean DMFT. It was also observed that the decrease of the prevention of dental caries is more reported in children than in adults. There was also consistency from the proofs of the reviews that when more than 1ppm of fluoride is ingested, there would be evidence of fluorosis. Therefore, the developing countries should be encouraged to adopt the use of fluoride-based supplements.

6.0 Reviewer's Conclusion

There is a confirmation from the reviews that the prevalence of dental caries in children can be reduced by water fluoridation. Furthermore, a relationship exists between an ingestion of above 1ppm of fluoride and fluorosis.

6.1 Implication for Practice

In the practice of dentistry, specifically dental therapy, the fluoride usage should be encouraged in the prevention of dental caries, and the ingestion of fluoride should not exceed 1ppm.

6.2 Implication for Research

There is a dire need to conduct more studies on water fluoridation due to fluoride variation in countries. Moreover, there is also a need to ascertain the amount of fluoride to be ingested in developed and developing countries so as to avoid the occurrence of fluorosis. It was also observed that there is scarcity of relevant materials on the effects of fluoridation of community water in developing countries like Africa. Therefore, there is need for study in this area

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