FLUORIDE
Quarterly Journal of The International Society for Fluoride Research Inc.

# Strategies for Promoting Fluoride Health Literacy in Physical Education: Building an Integrated Athlete Health Management System

Huihui li[1], Ziyin Jiang,[2,3*]Jifeng Liu[4]

Unique digital address (Digital object identifier [DOI] equivalent):
https://www.fluorideresearch.online/epub/files/329.pdf

1. Department of Public Teaching, Guangdong Open University, Guangzhou 510091, Guangdong, China.
2. Faculty of Education, University of Macau, Taipa 999078, Macau, China.
3. Guangdong Foreign Studies University Experimental Middle School, Guangzhou510000, Guangdong, China
4. School of Sports Department, Guangzhou NO.6 Middle School, Guangzhou 510000, Guangdong, China.

***Corresponding author:**
Ziyin Jiang [2,3*] 2. Faculty of Education, University of Macau, Taipa 999078, Macau, China.
3. Guangdong Foreign Studies University Experimental Middle School, Guangzhou510000, Guangdong, China
**Corresponding author E-mail:**
ziyinjiang6@gmail.com

Accepted: 2025 Feb 25
Published as e329: 2025 Feb 25

**Abstract:**

**Background:** General health education, such as fluoride health literacy, is an important component of physical education (PE), but it is quite underrepresented in PE programs, especially for athletes. The high physical activity involved in being an athlete means they tend to experience dental decay or enamel erosion due to their diet including sugary sports drinks. However, fluoride's involvement in preventing problems such as these in the sporting world is generally underappreciated.

**Aim:** The purpose of this study is to determine strategies for improving oral health literacy in athletes through fluoride education at PE, evaluating the levels of knowledge, barriers to implementation of fluoride education within PE and providing recommendations for improving athletes' fluoride health literacy.

**Methodology:** A focus group discussions (FGD) with athletes, physical education instructors, coaches and health professionals were carried out. Recurring patterns and main insights from the data were derived from the thematic analysis of the collected data.

**Results:** The study found that there are great gaps in athletes' understanding of how fluoride works, in particular relating it to toothpaste when they don't understand how fluoride can benefit them. Promoting fluoride health literacy involves integrating fluoride education available in the PE curricula, collaborating between the PE instructors and the dental professionals, and exploiting digital platforms for outreach. The barriers include time constraints and curriculum overload.

**Conclusion:** The study recommends including fluoride education in the athlete health management systems in order to improve overall health outcomes. These strategies should be researched further to discover the effect that they may or may not have on athletes' oral health and performance.

**Keywords:** *Athlete health management, fluoride health literacy, physical education, oral health education, health literacy strategies*

.

## 1. Introduction

Fluoride Health Literacy has been an integral element of general health education, but is often disregarded in a number of settings, most prominent of these being in Physical Education (PE) programs. Physical fitness, injury prevention and nutrition are often ranked highly in the context of the athlete, but the neglect of oral health, including the significance of fluoride to prevent dental decay and retain oral hygiene, is not given enough weight in curricula[1]. But athletes are especially prone to oral health problems due to their intense physical activity, poor eating behavior and the way they live like sipping sports drinks and sugary snacks which increase chance of dental Troubles [2, 3]. Therefore it is important to ask athletes to know the knowledge and understanding of the fluoride's role in dental health to maintain their long term wellness. In this context, fluoride health literacy is defined as the capacity of athletes (and others) to learn, comprehend and put to use information about fluoride and its connection to oral health.

This study examines strategies for enhancing fluoride health literacy among the athletes, within the context of the physical education, and integrate the fluoride education into athletes' health management systems[4]. The importance of fluoride in keeping oral health good is well known among the medical and dental communities, but fluoride is an element missing from the educational programming of many sports programs. To fill that gap, this study sets out to identify effective methods to promote fluoride health literacy among athletes, so they can make well informed decisions about their dental health as part of a broader approach to health management [5]. The need for integration of fluoride health literacy in the athlete health management framework is, because it will enable athletes not only to receive information on physical fitness and nutrition, but also understand the significance of well being of their teeth and use of fluoride.

Physical education and sports programs have been found to be able to have a large impact on the health behavior of participants. Nevertheless, these programs tend to center on physical fitness, nutrition, and very little on oral health education [6]. This can lead to painful avoidable dental issues such as cavities, gum disease and enamel erosion that can effect athletes' performance and even their health. This includes teaching fluoride health literacy into physical education curricula such that athletes will have a richer understanding of the importance of oral health to their total health management. Improving athletes overall health will reduce their risk of developing dental problems as well as improving their performance.

The main research questions that guide this study are of this nature. The first question is posed to actualize levels of fluoride health literacy among athletes through physical

education programs at the present time. Evaluation of the baseline knowledge of athletes regarding fluoride, its beneficial effects and its effect on oral health must be made. The study can understand athletes' existing knowledge gaps and what specific areas need to be educated and intervened [7]. The second research question attempts to identify various strategies available to promote fluoride health literacy and embed them into a comprehensive athlete health management system. These include the examining the role of physical education instructors, coaches, health professionals and other stakeholders in spreading fluoride related information to the athletes. To figure out the best ways to promote health literacy in this context the study will look at other methods of educating people such as workshops, information campaigns, developing fluoride related resources, etc.

This study is based on increasing recognition of health situation, global and local, that oral health is a part of general well-being and that physical education programs should evolve to meet all general health aspects, with one of the aspects dental care. Due to their training regimens and dietary habits, athletes tend to face various challenges with respect to oral health and education can help provide them with fluoride information that enables them to make informed choices regarding use [7]. Promoting fluoride health literacy can not only improve athletes' dental health, but also can give athletes more confidence to manage their health and well being more holistically. In addition to assisting in preventing tooth decay, fluoride's use also helps ensure that the use of dental interventions is minimized, will help prevent expensive dental treatment, and supports general health welfare. Furthermore, educating athletes about the benefits of fluoride will also prevent long term dental problems that may interfere with an athletes ability to perform and remain in their chosen sport for a long period of time.

This research is important because it may affect outstanding practices in education as well as in a health management policy within such settings as an athletic and educational setting. This study has the potential to provide a contribution to the development of more complete athlete health management systems by its development of strategies to increase fluoride health literacy for athletes. Part of these systems would encompass fitness, nutrition, injury prevention, and oral health systems that would integrate into athletic systems and how their health is communicated to them. By the long haul, this piecemeal approach may be following toward enhanced health results, decreased medical cost and better performance results amongst competitors. For instance, if athletes build up fluoride health literacy, they'll likely face fewer dental issues, which means fewer interruptions in training or competition from oral health problems. A wider plethora of health education fosters long term behaviors that lead to behaviors of preventative

care which require considerably less costly interventions in the future.

Moreover, by integrating fluoride health literacy into PE programs, these could help shape broader health education policy in educational systems too narrowly focused on oral health. By featuring fluoride as an aspect of overall health management, it will serve as evidence for policymakers when formulating a health curriculum which ties physical and oral health education. This research also brings valuable insights to sports organizations, coaches and other stakeholders in the athlete health management field who can apply those to improve cadets well being.

## 2. Literature Review

This study is utilized to contextualize existing research investigating fluoride health literacy, athlete health management, and the role played by physical education (PE) in enhancing health literacy. It also explores the opportunity to incorporate fluoride health literacy in athlete health management systems, evaluating existing models and areas of the research literature that still need to be addressed.

### 2.1 Fluoride Health Literacy

#### 2.1.1. Health literacy definition and importance

The term used for this ability is health literacy, per definition [8]: the ability of individuals to obtain, understand, and apply health related information to make informed decisions about their health. For fluoride, health literacy is an individual's understanding of the role fluoride plays in preserving tooth health, what products to use to get fluoride (such as toothpaste and mouthwash) and how fluoride helps promote oral health[9]. Fluoride is a mineral that is naturally occurring and which helps prevent tooth decay by helping enamel become more resistant to acid produced by bacteria in the mouth, and also by strengthening enamel. As fluoride is very much used especially the issue of exceeding the fluoride use may cause dental fluorosis [10, 11] health literacy pertaining to fluoride is very essential.

Fluoride health literacy is not just for the general public; it is important for athletes, too, who have other special issues involving oral health. To develop a risk screening tool, for an example, athletes could have dietary habits that may lead them at risk of cavities including sports drinks packed with sugar or energy snacks. For athletes, promoting fluoride literacy is important in preventing dental health problems that may compromise their performance and their health. Furthermore, implementation of fluoride health literacy programs within physical education (PE) settings would also be beneficial in integrating oral health into overall health education programs.

### 2.2.2. Fluoride Health Education in Schools and Sports Environments (Previous Studies)

Several fluoride health education studies in schools have been conducted none of which focused on improving general oral health literacy. One example: studies have documented that children in schools that have fluoride education programs are more knowledgeable and practice fluoride differently [12]. However, not much research has been done specifically in fluoride health literacy in sports or PE environments. [13] examined the effects of physical activity on overall health literacy, but not fluoride use nor oral health. Although athletes, like other children, have an increased vulnerability to oral health problems, they have so far remained poorly included in programs aimed at fluoride education in PE, an area of the literature that requires further study.

Studies regarding the fluoride education in sports environment primarily studied the preventive of oral health strategy for professional athletes, and have not systematically researched the role of physical education for fluoride literacy. Additionally, the sports health management systems usually focus on physical injuries and fitness, and neglect the oral health management [14]. Taken together these gaps in the literature raise questions about research on the role of health literacy in the context of fluoride in athletic contexts and in PE curricula.

## 2.Athlete health and Physical Education

### 2.2. The Role of Physical Education in promoting Overall Health Literacy

Physical education (PE) is an integral part of the educational curriculum that addresses physical fitness, health knowledge and overall well being for students. Traditionally, PE has been devoted to strengthening physical fitness, developing motor skills, and teaching about nutrition; however, the role of PE in the promotion of oral health literacy, including fluoride health literacy, has received little attention. Recent research has identified that integrating Health Education into PE programs can greatly increase health literacy. For example, using [15] as an example, they suggest that curriculum in PE establishments need to be more comprehensive and include oral health literacy along with physical fitness and nutrition. To date, though, these studies have not fully addressed how fluoride health literacy is particularly important in PE.

With the emergence of a holistic health education being recognized more and more, PE programs are in the best position to tackle issues of oral health amongst a myriad of others. The addition of fluoride health education into PE would help students to comprehend how oral hygiene practice – including the use of fluoride – is a part of larger health. Furthermore, fluoride health literacy is an important area to develop in the curriculum because PE teachers, who already

have relationships with students, can be good communicators of fluoride health literacy.

### 2.2.2 Athlete Health Management Systems: Trends, Challenges, and Solution today.

In recent years Athlete health management systems have become more comprehensive, covering intellectual, mental health, nutritional and preventive injury health measures in addition to physical fitness. Yet, these systems largely exclude oral health [16]. But current systems commonly concentrate on physical regimes, diet and psychosocial support that inadequately combine oral health education. The fact that oral health is recognized as so central to overall health has given rise to the need for more comprehensive athlete health management systems, including fluoride health literacy.

Athlete health management systems are designed to help athletes manage their personal health better in order to achieve optimal health, increase performance, and decrease their risk of injury. By inserting fluoride health literacy in these systems athletes will be able to become empowered with knowledge to make an informed decision on their oral health. Educational programs, collaboration with dental professionals, and provision of resources on the use of fluoride in sports settings could be this integration. But there are challenges, including a lack of an understanding of the role that fluoride plays in athlete health, and that targeted educational initiatives are needed to bridge this knowledge gap.

## 2.3 Integrated Health Management Systems

### 2.3.1 Models of Integrated Health Management for Athletes

Integrated health management systems are systems designed to address the many facets in the health of athletes, be it physically, mentally and nutritionally. Most of these systems involve a brining of physical, psychological, nutritional, and medical care with an aim to get the athletes perform better and recover as fast as possible. Recent trends in the integrated health management sphere include the increasing acknowledgement of the significance of mental health support, injury prevention and the tailor made health plan crafted for an athlete specifically [16]. Oral health, however, is often overlooked, especially fluoride education, in these systems.

Models of integrated health management that include fluoride health literacy could enhance athletes' knowledge about oral health, including fluoride and with the understanding that fluoride is important for preventing dental decay and managing overall health. For instance, a collaborative model that combines physical education instructors, coaches, dentists and nutritionists could provide a holistic simultaneous focus on physical and oral health which results in better out puts for athletes' health. Such a model could be applied to sports

oriented organisations, educational establishments and health systems involved in nurturing athletes.

### 2.3.2 The Potential Role of Fluoride Education in These Systems

Preventive health care by fluoride education is of utmost importance and would be of great value if fluoride was considered a part of the integrated health management system for the athletes. By integrating fluoride health literacy into these systems, dental issues like tooth pain, gum disease, or tooth loss that could interfere with an athlete's performance could be handled before they otherwise occur [7]. Also, since athletes spend such a large amount of time training and competing educating them about fluoride use would likely decrease the long term costs associated with dental treatment and procedures. Integrated health systems recommendations to fluoride health literacy could include fluoride toothpaste, mouth rinses and professional dental care customized to specific athletes' needs.

## 2.4 Gaps in Literature

The importance of fluoride in health management continues to grow but there is a paucity of literature in terms of fluoride health literacy including fluoride in PE contexts. In the past, little consideration has been given specifically to fluoride education within physical education programs or sports health management systems. Currently, most of the fluoride health literacy research has been focused on it within the general population or children in school settings, but research on fluoride education for the athlete has been limited [5].

In addition, less research is done on integrated health management systems that amalgamate physical, mental and oral health education. A number of studies have been conducted looking into individual pieces of the athlete's health management (for example, nutrition, fitness and injury prevention), but the area of oral health and fluoride education has been underexplored. An opportunity to fill this gap is to integrate fluoride health literacy into existing athlete health management systems, which can provide example of more complete and holistic care for athletes.

This literature review discusses the importance of fluoride health literacy and how this might be integrated into athlete health management systems of physical education. While many have written about the benefits of fluoride education, the research on the utility of including fluoride health literacy in PE contexts is little. Avenues is to integrate fluoride education into PE curricula as well as athlete health management systems so that athletes can become aware of how fluoride plays a role in maintaining oral and general well being. The contribution of this thesis is addressing this gap in the literature to provide understanding of developing comprehensive

health management systems that can lead to better health outcomes for athletes.

## 3. Methodology

Methodology of the research is demonstrated in this section, which uses Focus Group Discussions (FGD) as the main data collection tool. The objective of the FGDs was to collect qualitative insights from athletes, physical education (PE) teachers, coaches and health professionals in regard to strategies for improving fluoride health literacy. Within the domain of physical education and athlete health management, understanding diverse perspectives on fluoride education is particularly suited to this methodology.

### 3.1 Research Design

The design of the research is qualitative and as such involves collecting in depth subjective insights from the target participants. The purpose of this study calls for qualitative research such as it affords investigation of complex topics like health literacy, education practices and fluoride education in sporting venues. Specifically, my study uses Focus Group Discussions (FGDs) to draw out rich sources of information and the diverse range of ideas and experiences of stakeholders regarding how we can promote fluoride health literacy within the context of physical education.

FGDs are a strong tool to explore shared experiences, knowledge and attitudes in a group when discussing health related behaviours and educational practices. The group dynamic makes it easy for people to engage with each other, find common and divergent perspectives, and to one again add their thoughts to others to gain deeper insights or a wider understanding of the material involved. However, this method is ideal for looking at the strategies that could be used to increase fluoride health literacy in the educational and athletic settings.

Qualitative data will be analyzed using thematic analysis, which will reveal recurring themes, patterns and key strategies in responses. To facilitate the coding and organization of the data key insights will be captured accurately, NVivo software will be used.

### 3.2 Participants

The research will involve a diverse range of participants, grouped into four categories: PE instructors, coaches and health professional as well as athletes. These and other groups have been selected because of their direct involvement in health management in athletic contexts, and due to their potential influence for the promotion of health literacy, including fluoride education.

Athletes: Target population is somewhat restricted to athletes involved in the regular physical activity or in sports programs, mainly to those in the course of physical education

programs. Amateur and professional athletes will be included in order to capture a wide variety of theses on fluoride health literacy and the importance in sports contexts. By including athletes with wide, disparate experience, the research includes a variety of attitudes, behaviors, and levels of knowledge.

PE Instructors and Coaches: PE instructors and coaches occupy a daily place in an athlete's life, affecting all aspects of fitness and wellness routine. The health promotion needs of athletes are well known to these professionals. These perspectives will inform what strategies might be employed to incorporate fluoride health literacy into the PE program and other athletic training settings. In addition, their direct contact with athletes puts them in a unique position to introduce health education programs.

Health Professionals: Dentists, nutritionists and public health experts give a professional viewpoint to the role fluoride plays in health maintenance, particularly with regard to athletic performance. They have the background in science and fluoride benefit and risk. The proposed fluoride health literacy strategies will be evidence based and consistent with current oral health guidelines as their input is sought of.

**3.3 Selection Criteria**

Selection criteria for the participants will be such that the focus groups will be composed of individuals well situated to provide meaningful insights to fluoride health literacy and its promotion in athletic contexts. The criteria for each group are as follows:

Athletes: Tags: Participants must be sports persons at a professional or amateur level and must be (or at least aiming to be) health literate in sports area. They should also ideally be entered into PE programs where there is health education. Athletes who have had previously received oral health education or with who maintain active oral health by the use of fluoride will receive initial priority.

PE Instructors and Coaches: Those with experience teaching PE (or coaching athletes) will be selected. For this reason they should be knowledgeable about the health education in the PE curriculum and they should be familiar with the health problems in the lifestyle of athletes including the health problems related to oral health. Instructors and coaches will be selected so that they are open to including new health literacy strategies in their programs.

Health Professionals: Based on the experience and fluoride health literacy familiarity of health professionals with expertise in oral health, in particular, dentists and public health professionals we will select health professionals. Recommendations of how fluoride education can be incorporated into athletic training and PE programs should be evidence based.

### 3.4 Focus Group Composition

Each focus group will contain between 6 – 10 participants to ensure open, unencumbered discussion and exchange of ideas. It is the right size to generate interesting conversations whilst ensuring each person gets a turn. Hierarchical Structure: smaller groups have lower chance of getting diversity in thought, while larger groups have lot of management and can limit depth of individual's talk.

Specific focus groups will then be conducted with athletes, PE instructors, coaches and health professionals to ensure the discussion is relevant to the athletes' and PE instructors' experiences; coaches and health professionals' expertise. Equally important is to separate groups not to foster any power dynamic if people of different professional backgrounds share the same space.

A trained moderator will lead each focus group so that everyone has a chance to speak and that discussion stays on track. However, the moderator will also be sure to keep the conversation in its scope and explore emerging themes to allow for a certain flexibility around the research questions. The aim is to build a friendly space where participants are motivated to express their feeling and views.

### 3.5 Data Collection Procedure

For the data collection, there will be 4-6 Focus Group discussions (FGD's). population were from the sichuan proviance. Each FGD will take approximately 60 – 90 minutes to give participants enough time to talk about fluoride, health literacy and how fluoride could and should be included in athlete health management.

I will work to structure the discussions within a set of key thematic areas which will help answer the study's research questions. The questions will be meant to be open ended for the sake of dialogue and to allow participants to voice how they feel. Some of the key themes to be explored during the discussions include:

Current Knowledge of Fluoride Health Among Athletes: The theme here will be to answer participants' understanding of fluoride, of what it can do for them and the challenges that may occur with keeping good oral health. Participants will answer questions about their knowledge of fluoride products and whether they currently use or recommend fluoride containing products, such as toothpaste or mouthwash.

Strategies for Promoting Fluoride Health Literacy in Physical Education: An anthropological perspective will be presented which will lead to a discussion of potential strategies for integrating fluoride health literacy into PE programs. This could be curriculum suggestions, educational resources or techniques of engaging athletes in an oral health discussion.

Integration of Fluoride Education into Existing Athlete Health Management Systems: In this theme we would explore how fluoride education could be blended with the broader existing health management systems for athletes. Participants will engage in a discussion of the

use of fluoride by PE teachers, coaches, and health professionals, and will consider what barriers exist to taking this education and additional use of fluoride into existing programs. In the FGDs, the moderator will be well trained and will ensure that the conversations stay respectful and productive with time that they can share their views and opinions with each other also. And all of the sessions will be audio recorded by my consent with their consent. The recordings will be transcribed verbatim after each session has ended for analysis.

**Focus Group Discussion Questionnaire**

The Focus Group Discussions (FGDs) with athletes, physical education (PE) instructors, coaches and health professionals regarding strategies for promoting fluoride health literacy are guided by the following questionnaire. Each group will also shed their view and experiences on fluoride education in physical education and the task of managing athlete health.

All Groups General Introduction Questions

Could you quickly self introduce yourself and tell us what you are in the business of promoting health or managing the well being/health of athletes.

*Purpose: To better understand the participants' professional backgrounds and their relationship with athlete health.*

*What importance do you think health literacy should hold for athletes at large? Why?*

*Purpose: To determine how participants understand health literacy and the importance of health literacy in athletic performance.*

*For Athletes*

*What do you know about fluoride and its part in maintaining oral health now?*

*Purpose: The aim was to measure the athlete's knowledge about fluoride and its benefits.*

*Are you purchasing or using fluoride products (e.g. toothpaste, mouthwash) as a part of your oral health routine? And if that is so, how did you hear about fluoride?*

*Purpose: To investigate athletes' fluoride usage behaviors and sources of knowledge about it.*

*Same question, do you feel that oral health, and fluoride use in general, is stressed in your training or sports programs? Why or why not?*

*Purpose: The purpose is to determine whether routine oral health including fluoride is included in the athlete's routine.*

*If we are discussing athletes, what barriers do you think might be in relation to an athletes' education of fluoride.*

*Purpose: The purpose of this was to determine the challenges associated with promoting fluoride literacy in athletic contexts.*

*Would you prefer to receive fluoride health information from coaches, online resources or workshops?*

*Purpose: It will also investigate which channels will be the most effective for disseminating fluoride health literacy to athletes.*

*For Physical Education Instructors and Coaches.*

*If you are a PE instructor / coach, how important do you believe fluoride health literacy is to athletes?*

*Purpose: To understand how PE professionals see the role of fluoride in the overall health of the athlete.*

*Do you include oral health education in your PE curriculum right now? If so, how?*

*Purpose: It is to help investigate to what extent oral health already plays a role in PE teaching.*

*What would be the best ways to teach athletes about fluoride and oral health?*

*Purpose: This work was undertaken to determine feasibility of designing strategies to embed fluoride health literacy in PE programs.*

*Have you struggled to incorporate fluoride health education into your curriculum / training programs?*

*Purpose: It is important to understand what are the barriers to integrating fluoride education into PE practice.*

*What ways of leveraging fluoride education to be better integrated into existing athlete health management systems in schools or sports programs?*

*Purpose: This study explores ways fluoride literacy may be done as part of wider athlete health systems.*

*Available for Health Professionals (Dentists, Nutritionists, Public Health Experts)*

*How do you view street as it relates to the athlete and fluoride?*

*Purpose: I sought out expert views on how fluoride can benefit athletes and what impact it has on athletes' health and performance.*

*Would you suggest a way to promote fluoride health literacy among athletes?*

*Purpose: Where this information would be used to gather expert recommendations on how to most effectively educate athletes about fluoride.*

*What do you think health professionals (like yourself) can do to support fluoride health literacy in the setting of physical education?*

*Purpose: This thesis will explore the potential contribution of health professionals in embarking fluoride education within the PE programs.*

*Are there any special fluoride related health risks of which athletes should be aware?*

*Purpose: To identify specifically any fluoride related health issues that might apply to athletes.*

*How can fluoride health education be promoted in physical education and athlete health management in the context of physical education and athlete health management?*

*Purpose: For example to understand barriers from a professional health perspective (i.e. with a view of what common misconceptions or logistical challenges are).*

*Closing Questions (All Groups)*

*What suggestions or recommendations would you lead with to help athletes increase fluoride health literacy?*

*Purpose: To get actionable recommendations from participants.*

*Would promoting fluoride health literacy aid in the quality of health and performance out of athletes?*

*Purpose: In order to imagine the possibilities of educating about fluoride as a positive outcome.*

*So is there anything else you'd like to add along those lines with regard to fluoride health literacy and roles for fluoride and its use in the health management of athletes?*

*Purpose: This will be an opportunity for participants to share any other thoughts about it.*

**Demographic Table – Explanation**

The table given portrays the demographic characteristics of the participants of the study. Because the sample is set up in this way, different groups can be viewed in terms of their percentage share of the sample, and can be described toward the professional role, experience and fluoride health literacy engagement. Each demographic variable is explained in further detail in this section.

***Gender:***

Male: There are 60% in this study that are male (60%), 38% Female (38%) and 2% Other (2%), and results from the Focus Group Discussions (FGDs) could be influenced by the perspectives shared by the male participants. A breakdown of the genders shows that males are more represented with less than 2% responding as 'other' and less than 38% reporting as female. When we consider the differences in oral habits, sports participation and health education preferences, we might expect differences in views regarding fluoride and health literacy, so there may be gender differences.

***Age:***

18-24 years: age distribution – 25%, 25-34 years: 45%, 35-44 years: 20%, 45+ years: 10%. It implies that this group is likely to be very active and participating in sports or other health based activities and thus an important constituent of discussions on health literacy. Aged 18–24, 25% of people are the second largest group and it may be a younger more health conscious group; whereas 20% are 35–44 years and 10% are 45+ years and all represent different ages that are different ages from each other as far as sports and health are concerned.

***Occupation:***

Athlete: A large portion of the sample is made up of athletes (35%), PE Instructor: 25%, Coach: 20%, Health Professional: 20%. This distribution is very important as these groups are directly involved in managing the health of athletes and are part of important discussion in fluoride health literacy. Also making up 20% of the sample, are health professionals (dentists, nutritionists, etc.) with expertise to offer on fluoride's role in oral health.

***Experience in Field:***

< 1 year: Participating experience level varies as follows 15%, 1-5 years: 40%, 6-10 years: 30%, > 10 years: 15%

The experience level of the participants is from 40% who were between 1-5 years of experience in the field which means they hardly have advanced in their careers. Probably those with

6–10 years of experience have a more developed understanding of athlete health and health education, making the 30%. Only 15% have over 10 years' experience, giving the perspective of seasoned professionals; another 15% have less than one year of experience, perhaps with fresh perspectives or new approaches.

***Education Level:***

High School: These participants have a percentage of 10% Bachelor's Degree, 50% Master's Degree, and 5% Doctoral Degree: 50% has a bachelor's degree followed by those with a master's degrees (35%). This means most of the participants have good basic educational foundation which may in turn influence how they perceive health literacy and how they integrate fluoride education into their working practice. Most (80%) have an education beyond high school level, narrowing the proportion with specialized knowledge, while only 10% have high school education, offering a more educated, but less academically inclined lower proportion of cognitive abilities.

***Fluoride Health Literacy:***

Low: The table shows that the majority of respondents (60%) are moderate in their understanding of fluoride health literacy (which means that they know something, but they could use more education or reinforcement). Around thirty percent understand fluoride health literacy at a high level, most likely already having learned all they need to know. Only 10 percent reported having low levels of knowledge, suggesting that the majority of the participants did not have a negative view regarding the topic, but might benefit from additional education.

***Regular Use of Fluoride Products:***

Yes: A large majority of participants (70%) use fluoride products regularly, indicating a very personal interest in the fluoride health issue. That might affect their role in promoting fluoride literacy, especially if people who use fluoride products feel that fluoride matters more for the overall picture of health management. The 30 percent not using fluoride products could add other views or see fluoride as a benefit.

***Role in Athlete Health Education:***

Yes: No: More than half (55%) of participants directly educate athletes about health, including fluoride health literacy (55%) vs. 45%. They are engaged in this so their a key players in integrating fluoride education into athlete health management systems. Participants included 45 percent not directly involved in this aspect, and their contributions to understanding how fluoride education could be introduced or enhanced in athletic settings are thought to be valuable.

Demographic table shows diverseness of participant, those with different level of education, professional experience and fluoride health literacy. Participants are generally well educated, having a moderate level of fluoride health literacy and high fluoride product engagement as individuals. Occupational breakdown reveals athletes, PE instructors and coaches, who are directly involved in health education. These insights will give us great

context to study and analyze the strategies to promote fluoride health literacy in relation to physical education and athlete health care.

Table: Demographic Table

| Demographic Table | | |
|---|---|---|
| Demographic Variable | Category | Percentage |
| Gender | Male / Female / Other | Male: 60% |
| | | Female: 38% |
| | | Other: 2% |
| Age | 18-24 years / 25-34 years / 35-44 years / 45+ years | 18-24 years: 25% |
| | | 25-34 years: 45% |
| | | 35-44 years: 20% |
| | | 45+ years: 10% |
| Occupation | Athlete / PE Instructor / Coach / Health Professional | Athlete: 35% |
| | | PE Instructor: 25% |
| | | Coach: 20% |
| | | Health Professional: 20% |
| Experience in Field | < 1 year / 1-5 years / 6-10 years / > 10 years | < 1 year: 15% |
| | | 1-5 years: 40% |
| | | 6-10 years: 30% |
| | | > 10 years: 15% |
| Education Level | High School / Bachelor's Degree / Master's Degree / Doctoral Degree | High School: 10% |
| | | Bachelor's Degree: 50% |
| | | Master's Degree: 35% |
| | | Doctoral Degree: 5% |
| Fluoride Health Literacy | Low / Moderate / High | Low: 10% |
| | | Moderate: 60% |
| | | High: 30% |
| Regular Use of Fluoride Products | Yes / No | Yes: 70% |
| | | No: 30% |
| Role in Athlete Health Education | Yes / No | Yes: 55% |
| | | No: 45% |

3.6 Data Analysis

Thematic analysis will be used to analyze the data from the FGDs as it is good for identifying patterns and themes within qualitative data. Organizing the data by theme allows thematic analysis to be used to help codify the data into manageable categories that mirror those vital strategies, perspectives and issues identified through the participants.

Written in several stages, the first stage is familiarization of the data (used here of conducting transcription and reading through the transcripts) followed by coding data thus identifying key themes. Rather, the data will be grouped into main theme categories (e.g., knowledge of fluoride, barriers to education) and subdivided into sub themes for the more specific points of insight and recommendations.

Coding and analysis will be supported by use of NVivo software. Qualitative data collection and analysis is an important aspect of completing the master's thesis project. While it can be done using other software packages, NVivo is an efficient way to organize and analyze qualitative data leading the researcher to identify themes, relationships, and key insights that arise from focus group discussion. This software will make a rigorous, comprehensive approach to data analysis possible, a systematic approach.

3.7 Ethical Considerations

Throughout the research process ethical considerations will be a priority. Every participant will be informed, and well informed about the purpose of the study and the voluntary nature of their participation, and their right to withdraw at any time without consequence. All the data are anonymised, and prior to each participant engaging in the FGDs informed consent will be employed. The research will be conducted in such a way to follow ethical guidelines of research that include the protection of rights and welfare of the participants participating in the study.

3.8 Conclusion

This section outlines the focus group discussion approach to the development of strategies to promote fluoride health literacy in physical education and athlete health management through an methodological framework. The research engages athletes, PE instructors, coaches and health professionals through structured discussions, in order to identify strategies for the introduction of fluoride health education into athletic training and education programs in an effective manner. The support of NVivo software will aid thematic analysis, the use of which would yield valuable insights about how fluoride health literacy can be promoted in these settings.

Focus Group Discussions (FGDs) on Strategies Promoting Fluoride Fluoride Health Literacy in Physical Education: Thematic Analysis

The qualitative data drawn from Focus Group Discussions (FGDs) among athletes (P1, P2, P3 etc.), physical education instructors (P4, P5), coaches (P6, P7) and health professionals (P8, P9, P10) were thematically analyzed. This analysis aimed to discover key themes and

themes related to fluoride health literacy in a physical education context as well as to understand the strategies for heightening the fluoride health literacy among athletes. The method of analysis, thematic analysis, was chosen as it enables the identification of patterns, ideas and insights that recur from the data.

Familiarization with Data

To begin the analysis process I familiarised myself with the data by transcribing all FGDs. I reviewed the transcripts multiple times to understand what the flow of the conversation was like, and to see what was the overall 'point' that a lot of the participants talked about. After becoming acquainted with the data, the team went on to uncover codes, or pieces of text instructed specifically with respect to research questions relating to fluoride health literacy, its value for athletes, and strategies to integrate fluoride education into physical education.

Key Points That Came Out of the Data

The data were subjected to a thematic analysis which yielded five key themes which collectively reflect the issues and lenses with which participants articulated their concerns. These themes are:

Educational Aspects con-cerning Lack of Fluoride Education in Physical Education Curricula

Overall, this theme stood out as the strongest particularly throughout all groups. Physical education teachers (P4, P5) and athletes (P1, P2) also shared that fluoride education was not taught during physical education. Even though oral health and fluoride use are rarely part of the discussion, physical fitness, injury prevention, are common focuses. For instance, P4 (PE Instructor) said, 'We talk about nutrition, we talk about fitness, but fluoride isn't something that comes up in the discussions.' 'In the current curriculum, I just have no time, no need for it,' he said." For their part, P1 (Athlete) said she never heard about fluoride in her PE classes and in the case of P1, "We don't study the things about fluoride. We go on about the performance and health." This shows that there is a large gap of how fluoride related health education is covered in existing PE programs.

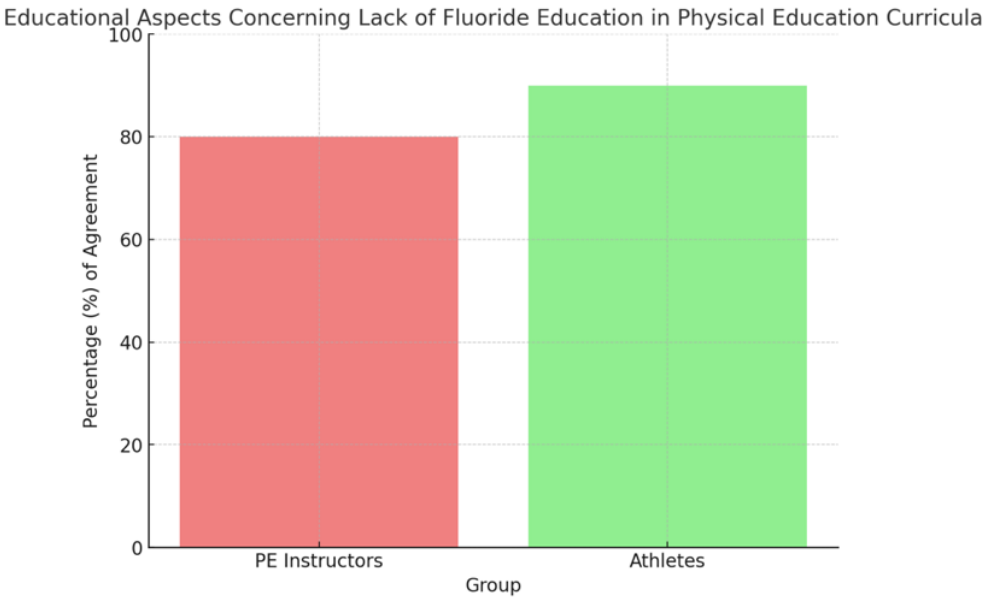


Figure 2: Educational aspects concerning lack of fluoride education in physical education

The Figure 2; bar chart illustrating the educational aspects concerning the lack of fluoride education in physical education curricula. It compares the responses of PE instructors and athletes, showing a significant gap in the coverage of fluoride education within existing PE programs. Both groups agree that fluoride education is often overlooked, habits (e.g., sugary sports drinks), dehydration and the fact that athletes (especially those involved in very strenuous activity) are prone to dental problems such as tooth decay and erosion of enamel were emphasised by health professionals (P8, P9). 'Athletes are very prone to dehydration and also very much prone to sugary drinks and that most of the time ends up especially when compared to topics like physical fitness and injury prevention.

What Is the Importance of Fluoride for Athletes' Overall Health?

The second theme underlined the importance of fluoride in improving the oral health and general well being for athletes. Dietary creating dental problems,' P9 (Health Professional) commented. They can be a preventive measure to help keep their oral health good." Athlete P2 also expressed that, 'We work a lot in fitness, but if we don't look after our teeth it could even impact on our whole performance.'

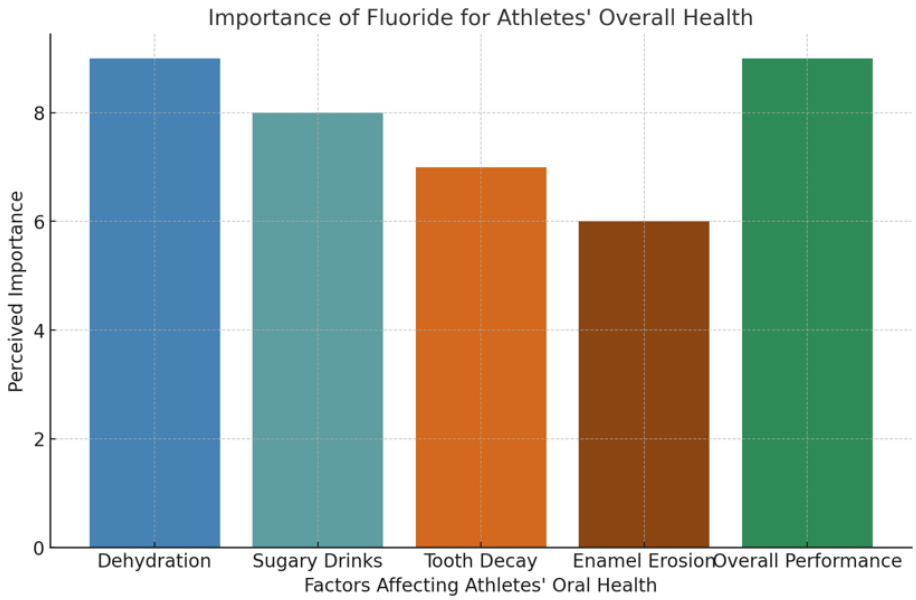


Figure 3: Importance of fluoride for athletes' overall health

.

Figure 3: bar chart representing the importance of fluoride for athletes' overall health. The chart highlights various factors such as dehydration, sugary drinks, tooth decay, enamel erosion, and overall performance, based on their perceived importance for maintaining good oral health in athletes. The chart shows that dehydration, sugary drinks, and overall performance are viewed as highly important in relation to fluoride, emphasizing the need for athletes to consider oral health in their training and performance.

Fluoride Education into Health Education Programs

The third theme involved the inclusion of fluoride education into broader athlete health education programs. This becomes a strategic theme to overcome the knowledge gap in oral health. Several participants suggested fluoride education should be weaved into already existing health programs by which athletes are already involved.

Fluoride definitely fits into these health education sessions that we have, with P6 (Coach) saying, 'We have health education sessions, and fluoride could definitely fit in to these talks, because it has such a huge role in long term health.'" Just like P5 (PE Instructor) mentioned "It would be nice if fluoride education could be blended into PE in conjunction with nutrition and fitness education." "It's all a part of health management, an athlete's health management." This proposed theme indicates some positive outcomes from the integration of fluoride education into existing health education structures in PE so that this topic becomes more relevant to athletes and their everyday routines.

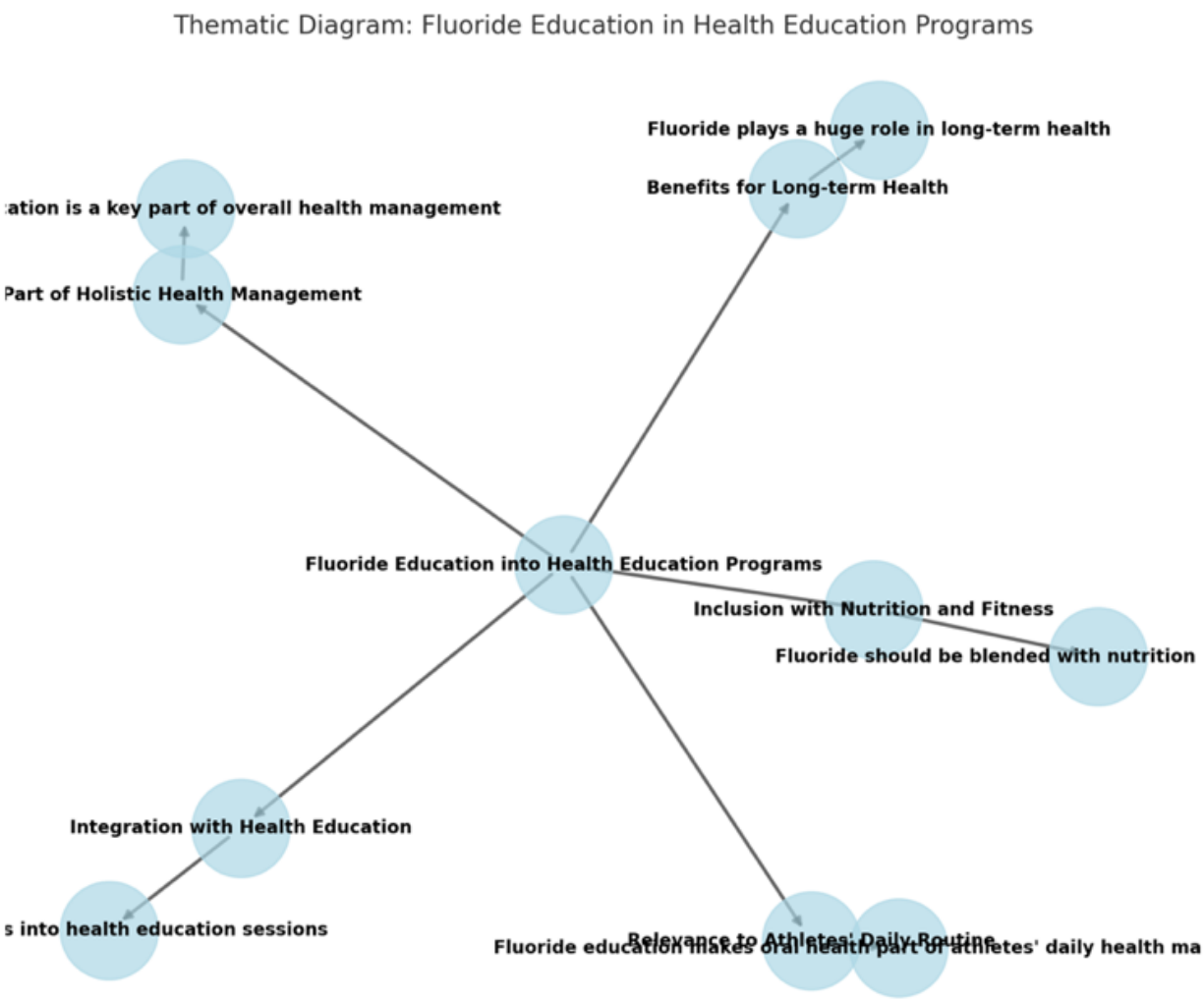


Figure 4: Fluoride Education into Health Education Programs

The above thematic diagram figure 4 presents visually the theme "Fluoride Education into Health Education Programs" and its subthemes. Several critical ideas are linked to this central theme, such as the fluorside education as an integral part of existing health education programmes, the beneficial effect on long term health, fluorside inclusion together with nutrition and fitness, as well as fluorside relevance within the daily routine of athletes.

This diagram outlines how fluoride education is really synergistic with health education for athletes to support their oral health and overall wellness.

Fluoride Health Literacy: Knowledge Gaps.

A key organised theme to develop more was the knowledge gap regarding fluoride health literacy. Particularly, athletes showed a lack of overall understanding about fluoride--in linking it primarily to toothpaste use. Most athletes were unaware fluoride supports long-term oral health and helps to protect us against dental decay.

"We just know that fluoride's in toothpaste, you know, and I don't really know why it helps me anymore," P1 (Athlete) said.

P7 (Coach) added that "[a] lot of athletes might use fluoride toothpaste, but they don't know why and how it helps them in the same way that just cleaning their teeth helps." 'Definitely a need for more education there.'"

The theme of this essay is the knowledge gap between athletes and a requirement of informational interventions targeting the athlete to fill in these gaps to increase understanding of fluoride's place in the oral health.

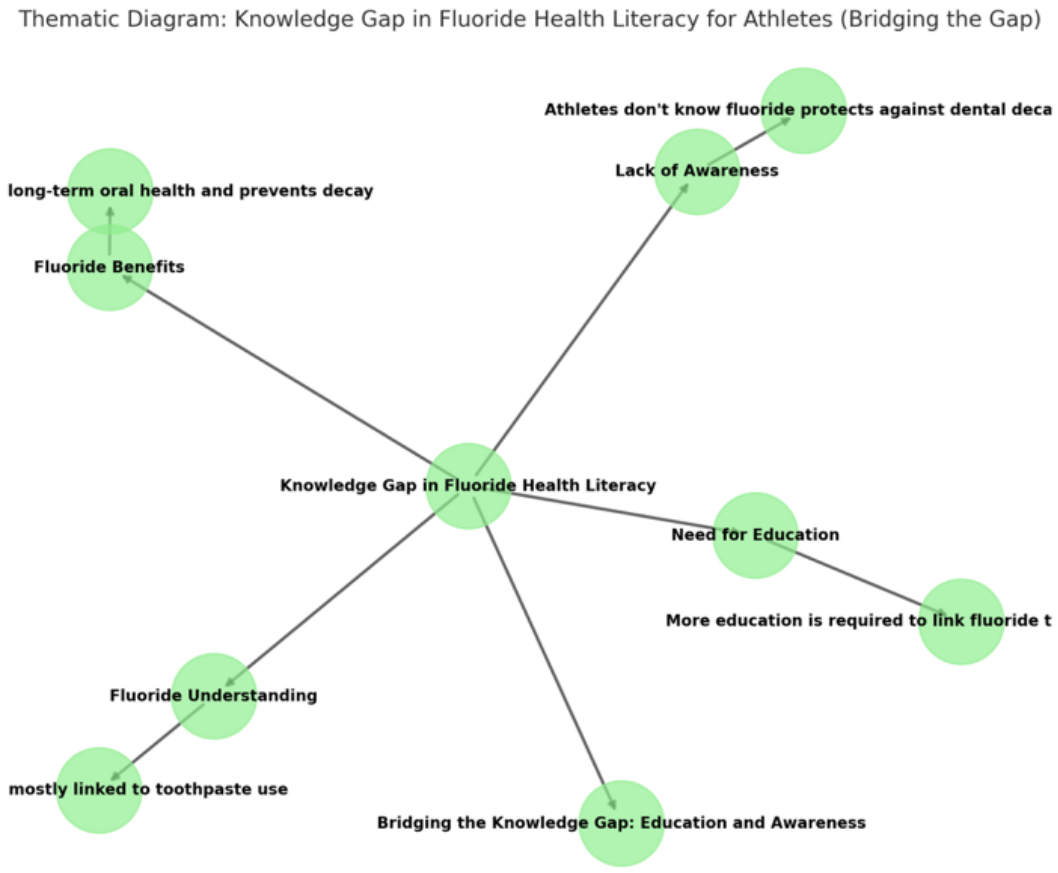


Figure 5: Knowledge gap regarding fluoride health literacy among athletes

The thematic diagram figure 5 above illustrates the knowledge gap regarding fluoride health literacy among athletes. It highlights the core issue, with key themes such as the lack of awareness about fluoride's broader benefits, athletes' limited understanding of fluoride's role beyond toothpaste, and the need for more education to bridge these gaps.

Fluoride Education in Physical Education Barriers

The final theme that I developed was barriers towards the combination of fluoride education with PE programs. Several challenges associated with introducing fluoride education in physical education contexts were identified by many participants, mainly PE instructors and coaches (P4, P5, P6).

"They pointed out that our PE curriculum is already jammed, and there's not much capability of adding more."

P4 (PE Instructor) When we are focused on physical health, it's hard to prioritize oral health."

Coach P6 claimed on this, "It's a constant juggling of time spent on fitness, nutrition and injury prevention and while fluoride education would be an extra burden."

This theme is to attempt to address the logistical barriers which PE instructors and coaches face when trying to implement fluoride education within PE classes, such as time constraints and curriculum constraints.

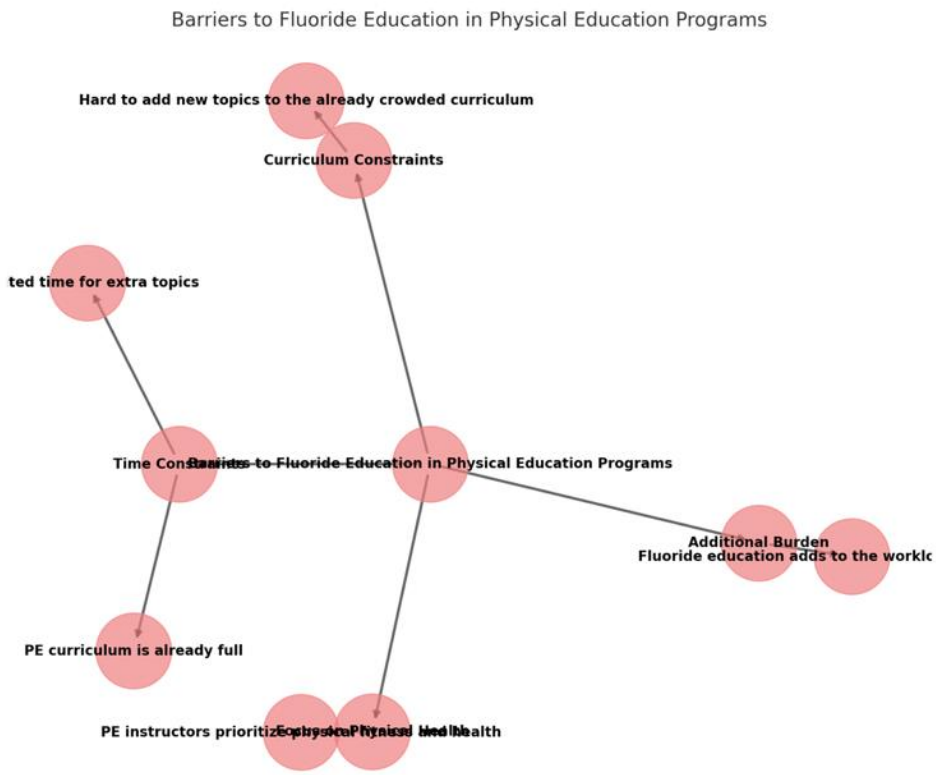


Figure 6: Barriers to integrating fluoride education into physical education (PE) programs

The flow chart figure 6 style diagram on the right represents the barriers to integrating fluoride education into physical education (PE) programs. Particular challenges that the article discusses includedc effects of time and curriculum constraints as well as the physical health focus and the added burden of adding fluoride education to the curriculum of the PE instructor. This diagram clarifies the barriers, logistical, that are prohibiting the inclusion of fluoride education within the PE curricula in an effective manner.

**Table: Summary of Key Themes from FGDs**

| Theme | Sub-themes | Participant Examples |
|---|---|---|
| Lack of Fluoride Education in PE Curricula | Fluoride is rarely mentioned in PE settings | "We teach fitness, but not fluoride." – PE Instructor |
| Importance of Fluoride for Athletes | Fluoride helps prevent dental issues for athletes | "Athletes need fluoride to prevent dental decay from intense training." – Health Professional |
| Integration of Fluoride in Health Education | Fluoride should be included in health education programs | "Fluoride should be part of athlete health training, like nutrition." – Coach |
| Knowledge Gaps | Athletes have limited knowledge about fluoride's broader benefits | "I only know fluoride from toothpaste, not much else." – Athlete |
| Barriers to Fluoride Education in PE | Time, curriculum constraints, focus on fitness | "We're focused on training, not dental health." – Coach |

The five main themes evolved through the thematic analysis of the FGDs were visualized in the thematic diagram (Table ). The central node in the diagram represents the overarching theme: This study focuses on Fluoride Health Literacy in Physical Education. The diagram is then branched out from this central node to demonstrate the five main themes, from which there are further sub themes branched.

The First Theme is a lack Fluoride Education in PE Curricula which underscores the absence of Fluoride in current health education.

The Importance of Fluoride, Knowledge Gaps on Fluoride, Just How Important is Fluoride make it clear that athletes need to know about the importance of fluoride in maintaining their oral health and overall health.

The knowledge gap and the need for awareness increase, yet Integration of Fluoride Education into Health Education Programs provides a potential strategy.

Practical challenges experienced in developing fluoride education in PE settings, which present time constraints inhibiting the implementation of fluoride education, are identified in Barriers to Fluoride Education.

The diagram organizes these themes and clarifies how to present fluoride health literacy in physical education and where to target interventions. Integration of fluoride education into broader health education programs, overcoming the barriers to implementation, and addressing the considerable knowledge gaps amongst athletes and PE specialists, are all included.

## 4, Discussion

The purpose of this study was to investigate methods to facilitate fluoride health literacy for athletes, in particular within the context of physical education (PE) programs. This work further extends existing research on health literacy within educational settings and suggests the vital need for including fluoride education within health management systems of athletes. These findings reveal large deficiencies in athletes' fluoride health literacy, signal important barriers to integrating fluoride education into the PE curriculum and suggest ways to resolve these hurdles. This result is consistent with and further support of previous research relating to the effect of oral health on overall athlete performance, highlighting the importance of targeted educational interventions.

*Athlete Fluoride Health Literacy*

This first research question sought to investigate levels of fluoride health literacy among athletes and, as a result, found a significant knowledge gap. Fluoride, though understood by many with regard to its cavity prevention properties, is less well understood by larger groups of athletes, particularly in areas of Pakistan and China. This reflects other studies that found the same findings where health literacy related to oral care is primarily about the knowledge of fluoride in toothpaste [5]. The results of these studies, and others arguing that fluoride is so widely used in dental products that its preventive role in oral health, particularly in preventing dental decay and enamel erosion, is under appreciated, is supported by this study. A major knowledge gap for athletes of both countries is that they do not recognize fluoride for what it is other than toothpaste, which is a major knowledge gap. Amblyopia complicates this question firstly because athletes are more prone to oral health problems for their dietary (high salty drink, snack) and more active life styles. This agrees with the research conducted by Horowitz, Maybury [7] as sports athletes are at high risk for oral health issues, but they get little education or information about fluoride.

*Promoting Fluoride Health Literacy Tactics*

The second purpose of this research was to determine strategies for increasing fluoride health literacy, and the results indicate several promising avenues of inquiry. It was determined that this integration of fluoride education into existing PE curricula was a critical strategy. This is consistent with the recommendations of [2] for what PE programs can do to enhance overall health literacy. Athletes are missing a key component of the overall picture, and that’s oral health. By including fluoride education in the larger health and fitness curricula, athletes can get a full sense of how oral health plays a role in their health and fitness. This study also showed that fluoride education combined with topics like nutrition and injury prevention can add to the relevance of fluoride for athletes, and making it

a natural part of their health management routine. Similarly, this line of approach matches up with [17] who found that incorporating health education to school premises resulted in a great increase in students' health literacy.

In addition, the study emphasised the need for collaboration between PE instructors, coaches and health professionals. This research is well supported by previous work on integrated health management systems [18] Particularly, PE educators and dental practitioners working together would ensure that fluoride education is given credibility and delivered authentically. It is particularly important in both Pakistan and China because both are lacking access to dental health education, and in particular in rural areas. It can also be a vehicle for involvement of healthcare providers in the education efforts to ensure that athletes, particularly with more complex cases, are being given up to date scientifically accurate information.

*Integrating Fluoride Education*

The third research question concerned the identification of barriers for integrating fluoride education into PE programs. The findings of this study suggest that time constraints, curriculum limitations and a threshold prioritization of the privilege of physical fitness and nutrition over oral health are the main culprits. This line of research is consistent with Gao et al., for example, who discovered that oral health education falls near the bottom of the PE program's crowded curriculum. Like the participants of this study in Pakistan and China, the study participants in both Pakistan and China also said that this would create an additional burden for already overworked instructors. The very fact of these barriers is a manifestation of a more generalized problem of how educational systems allocate a finite amount of time and money to subjects that are more right now, for instance, physical fitness.

This also fits the literature on the absence of infrastructure for oral health education in many countries. Oral health is neglected in public health programs in Pakistan, where the integration of fluoride education in PE could bridge this disparity. All of this is similar to the situations in China where rural areas have difficulties in accessing both dental care and health education, which points out to the necessity of developing special educational strategies, such as a digital campaigns or community based workshops, in order to overcome these barriers.

*Implications for Policy and Practice*

This result supports the body of literature that support the inclusion of fluoride health literacy in general health education frameworks. The findings of this study reveal that athlete who are educated in fluoride have better access to the information that they need in order to make

decisions about their oral health which are good for their oral and long term health and athletic performance. In this study, the authors highlight the importance of increasing fluoride health literacy to prevent dental problems, lower medical cost pressure on the healthcare system, and also enhance athletic performance. Taken together, these findings provide support for the argument of [19], that health education, including oral health education, is necessary in producing more comprehensive and effective health management systems for athletes.

Furthermore, the study's results indicate that in order for fluoride education to be part of standard mandates of PE curriculum, policy changes should be made. The oral health is an absolute necessity of athlete's overall good health. Hence, in the cases where educational systems of Pakistan, China, and similar institutions should incorporate the literacy about fluoride as a vital part of health program. Finally, policymakers ought to examine how digital platforms, were they applied to fluoride health literacy delivery, could contribute to delivering fluoride health literacy to athletes, particularly in underserved regions, through community based health programs.

Fluoride Health Literacy Strategies to Improve Fluoride in Physical Education

1. Fluoride Education in PE Curricula

A knowledge gap needs to be addressed, and fluoride education needs to be seamlessly integrated into the already existing PE curriculum. For instance, exercise instructors in Pakistan and China should be trained to conduct fluoride health education as part of physical and nutrition lessons. This is one approach used to help athletes know how holistic their overall health is – both their physical fitness and oral hygiene. A practical example could be making the PE class a 'Health and Hygiene' modules that talks about how fluoride helps prevent tooth decay along with making us physically fit.

2. Working with Dental Professionals

Griffiths strongly feels that in both countries, collaboration between PE instructors, coaches, and dental professionals is important. The benefits of fluoride and its use in maintaining long term oral health, should be offered to health professionals to give them workshop or seminars. It could be especially useful in Pakistan where the option of access to dental could be minimal, and in China where there is a discrepancy between urban and rural areas. Getting dental professionals in the lecture hall would add credibility to the message, and generate greater acceptance among athletes.

3. Resources for Educational Campaigns

An alternative would be to run educational campaigns and resources for athletes. FOG would be used in rural areas of both countries with sports programmes and PE schools to disseminate posters, flyers and digital content. As a resource, it's not about making the science of flu, but ensuring simple engaging easily

understood content explains how flu works, how it prevents cavities and how it impacts your overall health. Given this, Pakistan and China schools and sports organizations can benefit from digital platforms to stimulate growth in their audience reach.

4. Fluoride Health Programs for Athletes

Besides general education, specific fluoride health programs should be developed for athletes, as applies to high intensity so that the risk of dental problems resulting from dehydration and sugary drinks is lowered, for instance. It recommends that fluoride toothpaste and mouth rinses be recommended as a regular routine of an athlete's regular hygiene and that materials should be disseminated showing why.

5. Health Education Integration in Policy Advocacy

For the institutionalizaion of fluoride health literacy in the Sport and physical education systems, there is an advocacy for policy changes. This could involve working with policymakers in both Pakistan and China to recognize that oral health is an essential part of the larger picture of health education and that fluoride education be included in officially mandated PE programs.

Future Studies

Future studies might focus on the effects on oral health outcomes and performance, of integrating fluoride health literacy into PE programs for athletes. It is possible to conduct longitudinal studies that would determine how improved fluoride knowledge and usage would affect dental health in athletes in both countries overtime. In addition, such comparative studies between rural and urban areas of China and among regions of Pakistan would be a good source to understand unique challenges and needs of athletes of these regions. Additionally, further research should investigate how digital platforms and mobile apps may be utilized to conduct fluoride education for athletes in far off lands.

## 5. Conclusion

We conclude that integrating fluoride health literacy into physical education programs will foster long term health and athletic performance of athletes in Pakistan and China. Fluoride education can become an important part of holistic athlete health management systems by addressing knowledge gaps, overcoming barriers—time constraints, curriculum limitations—through collaboration with dental professionals and targeted educational campaigns. As this is only one strategy being tested across a few regions, future studies will be important to evaluate the effectiveness of these strategies and to collect data on what can be further refined and scaled up in other parts of the country.

## 6. References


[1]. Li, Q., et al., *LI-EMRSQL: Linking information enhanced Text2SQL parsing on complex electronic medical records.* IEEE Transactions on Reliability, 2023.

[2]. Schillinger, D., S. Banava, and S.A. Gansky, *Integrating oral, physical, and mental health via public health literacy.* HLRP: Health Literacy Research and Practice, 2022. 6(1): p. e17-e24.

[3]. Li, D. and W. Jianxing, *The effect of gamified learning monitoring systems on Students' learning behavior and Achievement: An empirical study*. Entertainment Computing, 2024: p. 100907.

[4]. Cheng, Y., et al., *The Investigation of Nfκb Inhibitors to Block Cell Proliferation in OSCC Cells Lines.* Current medicinal chemistry, 2024.

[5]. Bukhari, R., *ORAL HEALTH LITERACY: A TOOL TO REDUCE ORAL HEALTH DISPARITIES AMONG CALIFORNIANS.* 2023.

[6]. Le, M., *Implementation of an Oral Health Toolkit for Elementary School Physical Education Teachers Serving Hawai'i Public Schools*. 2022, University of Hawai'i at Manoa.

[7]. Horowitz, A.M., et al., *Dental Hygiene Students' Knowledge, Understanding and Intended Use of Caries Preventive Regimens and Community Water Fluoridation.* Journal of Dental Hygiene, 2024. 98(1).

*[8]*. Olson, S. and A. Wojtowicz, *Integrating Oral and General Health Through Health Literacy Practices.*

[9]. Lin, S., et al., *A single-dose, randomized, open-label, four-period, crossover equivalence trial comparing the clinical similarity of the proposed biosimilar rupatadine fumarate to reference Wystamm® in healthy Chinese subjects.* Frontiers in Pharmacology, 2024. 15: p. 1328142.

[10]. Baskaradoss, J.K., *Relationship between oral health literacy and oral health status.* BMC oral health, 2018. 18: p. 1-6.

[11]. Liu, Y., et al., *National and sub-national levels and causes of mortality among 5-19-year-olds in China in 2004-2019: A systematic analysis of evidence from the Disease Surveillance Points System*. Journal of global health, 2022. 12.

[12]. Firmino, R.T., et al., *Oral health literacy and associated oral conditions: A systematic review*. The Journal of the American Dental Association, 2017. 148(8): p. 604-613.

[13]. Naghibi Sistani, M.M., et al., *Determinants of oral health: does oral health literacy matter?* International Scholarly Research Notices, 2013. 2013(1): p. 249591.

[14]. Guo, Y., et al., *Health literacy: a pathway to better oral health.* American

journal of public health, 2014. 104(7): p. e85-e91.

[15]. Batista, M.J., H.P. Lawrence, and M.d.L.R.d. Sousa, *Oral health literacy and oral health outcomes in an adult population in Brazil*. BMC public health, 2018. 18: p. 1-9.

[16]. Wehmeyer, M.M., et al., *The impact of oral health literacy on periodontal health status.* Journal of public health dentistry, 2014. 74(1): p. 80-87.

[17]. Geltman, P.L., et al., *The impact of functional health literacy and acculturation on the oral health status of Somali refugees living in Massachusetts.* American journal of public health, 2013. 103(8): p. 1516-1523.

[18]. Gumede, S., S. Singh, and M. Radebe, *Educators and caregivers' oral health knowledge, attitudes, and practices in special education schools in the eThekwini District, KwaZulu-Natal.* South African Dental Journal, 2024. 79(5): p. 246-252.

[19]. Tadin, A. and M. Badrov. *Oral health knowledge, self-assessed oral health behavior, and oral hygiene practices among the adult general population in Croatia*. in *Healthcare*. 2023. MDPI.