European Academy of Pediatric Dentistry

BLACK STAIN IN CHILDREN: A SYSTEMATIC REVIEW

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BLACK STAIN (BS): extrinsic tooth discoloration (Reid, 1977)
- a dark pigmented line/incomplete coalescence of dark spots
- usually localised following the contour of the gingival margin

→
- Firmly attached to the tooth surface
- At least 2 teeth



Common in children, affecting primary and permanent dentitions
Not related to impairment of dental health: an aesthetic problem

→ The causative factors not fully understood

→ The **objective** of this study was to systematically review **its causing** and/or **contributing factors**

A **systematic** electronic search: **Pubmed**, **Cochrane Library**, **ISI Web of Science and Embase** databases

Keywords related to: “black stain", "tooth" and "children"

(black stain OR black stains OR black dyschromia OR black discoloration OR black extrinsic discoloration) AND (teeth OR dental OR tooth)

→ **Inclusion criteria**: BS prevalence, BS etiology, factors associated (caries, plaque/salivary microbiota, hygiene/dietary habits) and mechanism of BS formation, without time limit

→ **Exclusion criteria**: case reports, reviews, non-English articles

Papers were selected after a **review** of their **TITLE**, **ABSTRACT** and **FULL TEXT**
Manual screening was conducted on the bibliographies of the remaining papers

The search was carried out **independently** by **two authors** in collaboration (ED, JPA)
In case of desagreement, a **consensus** was achieved by consulting a **third** reviewer (PM)

Papers were selected if:
- study well-conducted
- clarity in the method and the results

206 articles were listed on **Pubmed, Cochrane Library, ISI Web of Science and Embase**

After **FULL READING**, according to inclusion and judgment criteria :

26 articles selected

36 articles excluded

5 articles were manually added

31 articles were finally included

PREVALENCE

From **1.6** to **18%,** with **no difference** between **boys and girls**

(Sutcliffe, 1967, 1,6%; Garcia- Martin, 2013, 3,1%; Koch, 2001, 6,3%; Gasparetto, 2003, 14,8%; Heinrich-Weltzien , 2009, 16%; Bath, 2010, 18%,; Boka, 2013, 2,4%,; Chen, 2014, 9,9%)

Chen, 2014: number of stained teeth increases with age

more stained teeth were observed in permanent dentition

CARIE EXPERIENCE

França-Pinto, 2012: BS might be a protective factor for dental caries development

- children **with BS** have **less caries** (Shourie, 1947, Koch, 2001; Heinrich-Weltzien, 2009/2014, Bhat, 2009; Boka, 2013, Chen, 2014; Shmuly, 2014)

- no **statistical difference** caries prevalence/BS (Garcia-Martin, 2013; Gasparetto, 2003)

DARK COLOR AND CHEMICAL COMPOSITION

- Insoluble ferric salt could be responsible for the dark color (Reid, 1974; Li, 2015)

HYDROGEN SULFIDE
Bacteria

+

IRON
Saliva/gingival exudates (or bleeding)

→

FERRIC SULFIDE

Parnas et al. 2013: metallic ions from metallic instruments used to collect the samples

Tantbirojn, 1998 : traces of iron on extracted teeth collected without metal instruments

Spatial chemistry analysis: areas of high iron/copper concentrations ↔ areas of high sulfur concentration

- High content of calcium and phosphate (Reid, 1976/1977)

MICROBIOLOGY OF BLACK STAIN

Former studies: **Prevotella melaninogenica** closely related, form a dark pigment (Reid, 1976; Shah, 1979)
however, different Actinomyces species also produced pigment

Saba et al. 2006; Costa et al. 2012: *Actinomyces israelii/naeslundii predominant*
Slot 1973: *Streptoccocus mutans* tends to be less prevalent

Li et al. 2015: microbial diversity reduced in plaque (and saliva): Actinomyces, and others...

SALIVARY PARAMETERS

Surdacka et al.1989, Garan et al. 2012, Aysun et al. 2012:
levels of Ca, inorganic phosphates, higher levels of salivary buffering capacity → Low caries tendency

FACTORS CONTRIBUTING

DIET

Pushpanjali, 2004; Franca-Pinto, 2012
Garcia-Martin, 2013; Chen, 2014

Correlation BS/concentration of iron in food, water
→ vegetables, fruits, dairy products, soy sauce

MEDICATIONS

Garcia-Martin, 2013
Iron supplementation among the mothers during pregnancy/in childhood

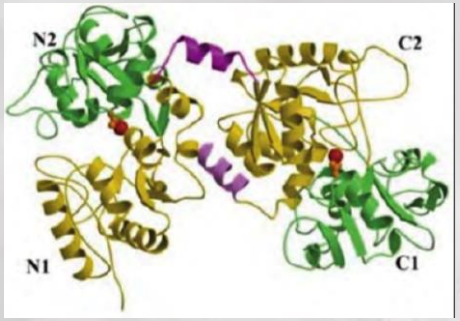
ORAL HYGIENE

Contrary findings (Garcia Martin, 2013; Chen, 2014)

Contrary findings (Franca-Pinto, 2012; Chen, 2014)

SOCIO-ECONOMIC STATUS

LACTOFERRIN



Nordbo: level of salivary lactoferrin ↑↑ in persons with extreme staining tendency

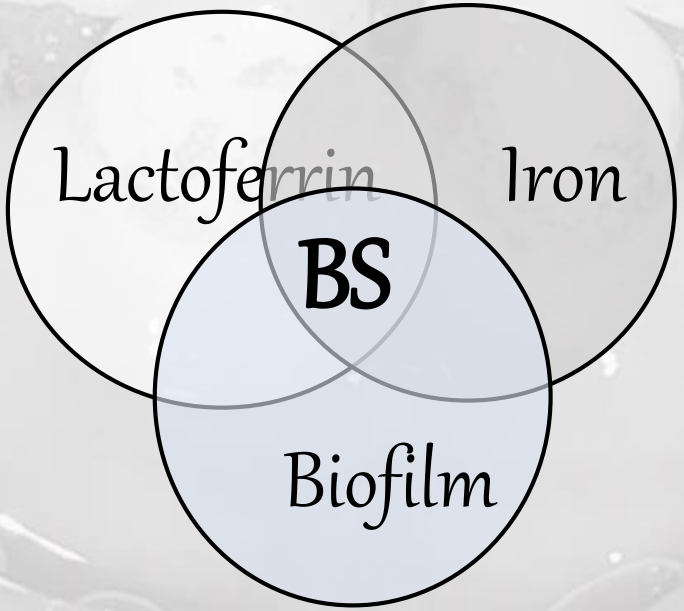
in vitro: lactoferrin + irons + tannic acid → stain on slabs of enamel /dentin

Lactoferrin: iron-binding glycoprotein, bovine lactoferrin has a major affinity

Lactoferrin from dairy products captures saliva iron

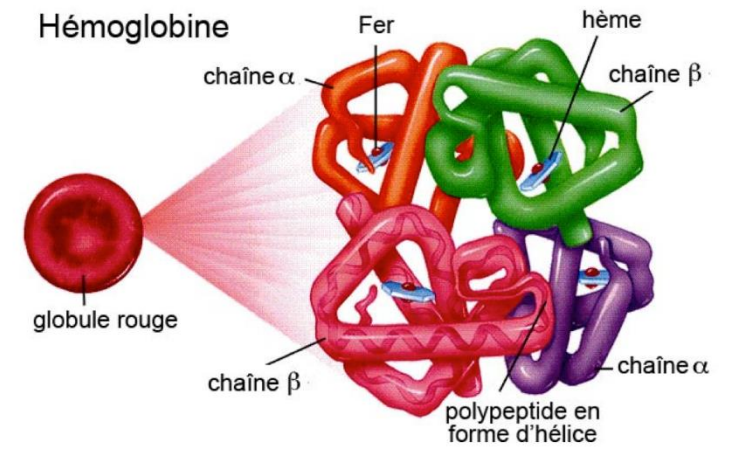
Applies itself to the biofilm

Release the iron, which combines in situ with bacteria's sulfurs



FORMATION OF BLACK FERRIC SULFUR

LACTOFERRIN



Mesojesi 2011: BS might be iron-saturated bovine lactoferrin

If no iron supplement taken or individual not have frequent gingival bleeding

→ can indicate iron deficient anemia

→ bind iron in high concentration in saliva in persons with iron deficient anemia/thalassemia minor

TAKE HOME MESSAGE

The dark color may be related to iron/copper and sulfur complexes

Saliva in BS patients: higher Ca concentrations + higher buffering capacity

Multiple bacterial are involved with a dominance of *Actinomyces ssp*
Possible lower presence of Streptococcus

→ lower caries experience in BS patient

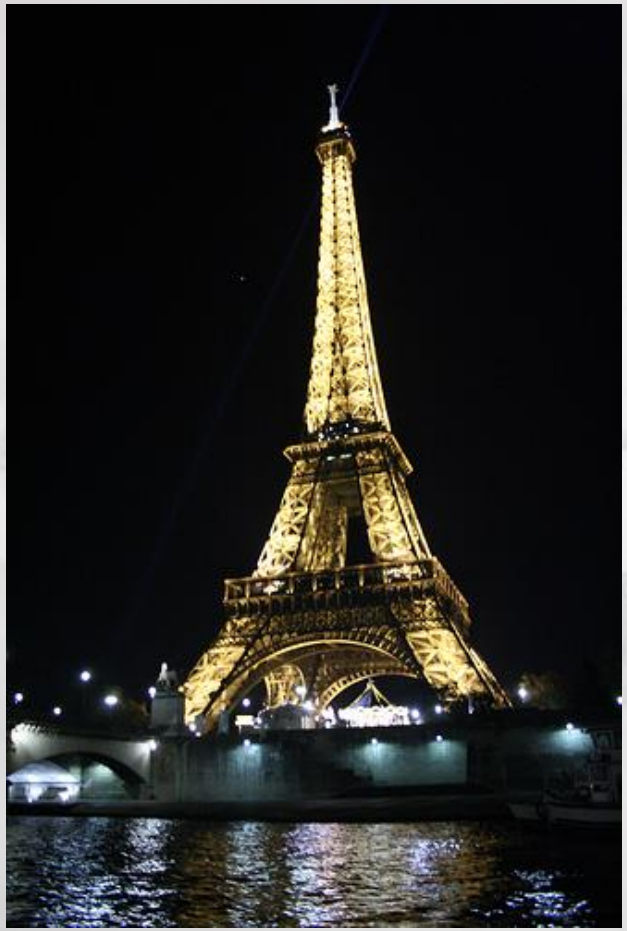
BS could be the results 3 concomitant factors: lactoferrin + iron + specific bacteria

PERSPECTIVES

To limit BS:

- define/elaborate a standard medical interview
- decrease irons source from alimentation or supplementation
- decrease dairy products or brush teeth just after their consumption
- measure lactoferrin, search other pathologies...

➡ Further research needed to elucidate the mechanism of BS formation
to explore the microbiologic and causal factors using prospective studies



Thank You for Your kind Attention