

# بسم الله الرحمن الرحيم





# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم





# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار





# بعض الوثائق الأصلية تالفة







بالرسالة صفحات  
لم ترد بالأصل



B1 ✓ C ✓ E

# **EFFECT OF FOLIC ACID ON TOOTH DEVELOPMENT IN ALBINO RATS.**

## **Thesis**

Submitted to the Faculty of Dentistry  
University of Alexandria  
In partial fulfillment of the  
Requirements for the degree of

## **Master in Oral Biolgy**

**By**

**Maha Abd El-Ghaffar Abd El Gawwad El-Shahawy.**

(B.D.S, 1998)

Faculty of Dentistry  
Alexandria University

2005

## SUPERVISORS

**Prof. Dr. Afaf Abd-El-Khalek El-Sawa**

Professor of oral Biology

Faculty of Dentistry

Alexandria University

**Prof. Dr. Ali Abd El-Halem Abd El-Azim**

Professor of oral Biology

Vice dean for students affair

Faculty of Dentistry

El Minia University

**Dr. Amel Radwan El-Hak**

Assistant Professor of oral Biology

Faculty of Dentistry

Alexandria University

**Dr. Soheir Mahmoud El-kholy**

Assistant Professor of Biophysics

Medical Research Institute

Alexandria University



## **ACKNOWLEDGMENT**

Thanks to God, greater of all for giving me strength and patience to accomplish this work.

As a start, words cannot describe how grateful I'm to Prof. Dr. Afaf El-Sawa, professor of oral biology, faculty of dentistry, Alexandria University, for the suggestion of this point of research, for her close supervision, continuous insistence on perfection and encouragement throughout this study.

My thanks are also extended to Prof. Dr. Ali Abd El-Azim, professor of oral biology, vice Dean of faculty of dentistry, El-Minia University, for his valuable advices, continuous encouragement and unlimited help.

I would like to express my deepest gratitude and appreciation to Dr Amel El-Hak, Assoc. Prof of oral biology, faculty of dentistry, Alexandria University, for her unlimited help, precious advices and without her constant supervision throughout this study, thesis couldn't have achieved to present form.

I'm greatly grateful to Dr. Sohir El-Kholy, Assoc. Prof. Of Biophysics, and Medical Research institute, Alexandria University, for her kind assistance in fulfilling the electron-microscopic part of the present work.

I also would like to thank with deep gratitude all the members of the oral Biology Department, Alexandria University and El-Minia University for the facilities they offered.



Finally and not lately, I'm greatly indebted to my husband, Mohamed Shaltout, Assi. Lecture of physical oceanography , faculty of science, Alexandria University, for his kind patience and to my family for their help and continuous support till this work is accomplished.

**To my parents,**

**To my husband,**

**To my little sweet Ahmed**



# LIST OF CONTENTS

Chapter		Page
	List of figures	
	List of tables	
	List of graphs	
	List of abbreviations	
I	Introduction	1
II	Review of literature	4
III	Aim of the work	25
IV	Materials and methods	26
V	Results	41
VI	Discussion	112
VII	Summary	123
VIII	Conclusion and Recommendations	130
IX	Referances	131
	Protocol	
	Arabic summary	

## LIST OF FIGURES

Figure No.	Title	Page
1	showing the used folic acid in the tablet form.	32
2	the upper and lower jaws are separated and the developing mandibular first molar is held by forceps.	32
3	Light micrograph shows the histology of tooth development at the bell stage with differentiated four layers of the enamel organ [outer enamel epithelium (OEE), stellate reticulum (SR), stratum intermedium (SI) and differentiating inner enamel epithelium (IEE)]. A thin layer of predentin (Pd), odontoblast cells (O), dental papilla (DP) and dental sac (DS) are seen. Developing mandibular first molar of rat euthanized immediately after birth ( <b>control group</b> ). (H&E , orig.mag. x 40)	43
4	Higher magnification of the previous figure shows: the dental sac (DS), stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelium (IEE), predentin (Pd), odontoblasts (O) and the dental papilla (DP). (H&E orig.mag. x 200)	44
5	H M of the previous figure shows: the stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelium (IEE), predentin (Pd), odontoblasts (O) and the dental papilla (DP). (H&E orig.mag. x 400)	45
6	Shows bell stage (early crown formation) of tooth development with well differentiated four layers of enamel organ (outer enamel epithelium (OEE), stellate reticulum (SR), stratum intermedium (SI) and differentiating inner enamel epithelium (IEE)]. Thin layer of predentin (Pd), odontoblasts (O), dense dental papilla (DP) and dental sac (DS) are seen. Developing mandibular first molar of rat euthanized immediately after birth of <b>study group a</b> (mothers received folic acid once the pregnancy recognized). (H&E orig.mag. x 40)	46
7	H M of the previous figure shows: dental sac (DS) stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelium (IEE), predentin (Pd), odontoblasts (O) and cells of dental	47



- papilla (DP).  
(H&E orig.mag. x 200)
- 8 H M of the previous figure showing: stellate reticulum (SR), stratum intermedium (SI), dense and well organized differentiating inner enamel epithelium (IEE), predentin (Pd), odontoblasts (O) and cells of dental papilla (DP). 48
- (H&E, orig.mag. x 400)
- 9 Shows: the histology of initial dentinogenesis at the beginning of the appositional stage with well differentiated four layers of enamel organ (outer enamel epithelium (OEE), stellate reticulum (SR), stratum intermedium (SI) and differentiating inner enamel epithelium (IEE)]. Layer of predentin (Pd), odontoblasts (O), dense dental papilla (DP) and dental sac (DS) are also demonstrated. 49  
Developing mandibular first molar of rat euthanized immediately after birth of **study group 1** (mothers received folic acid 7 days before caging).
- (H&E, orig.mag. x 40)
- 10 H M of the previous figure shows: well organized dense stellate reticulum (SR), stratum intermedium (SI) and differentiating inner enamel epithelium (IEE). Odontoblasts (O) are arranged on the periphery of the densely packed dental papilla (DP) forming a layer of predentin (Pd). 50
- (H&E, orig.mag. x 200)
- 11 Another light micrograph H.M shows: stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelium (IEE), homogenous layer of predentin (Pd) increased in thickness at the cusp tip area and densely packed enamel organ cells together with odontoblasts (O) and dental papilla (DP). 51
- (H&E, orig.mag. x 200)
- 12 Another light micrograph H.M shows: stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelium (IEE), homogenous layer of predentin (Pd) increased in thickness at the cusp tip area and densely packed enamel organ cells together with odontoblasts (O) and dental papilla (DP). 52
- (H&E, orig.mag. x 200)
- 13 Shows: bell stage when the apposition is near completion with cusps formation, pulp tissue (P), odontoblasts (O), predentin (Pd), dentin (d), enamel 54



matrix (EM), ameloblasts (A), stratum intermedium (SI), stellate reticulum (SR) and dental sac (DS).

Developing mandibular first molar of rat euthanized 7 days after birth of **control group**.

(H&E, orig.mag. x 40)

- 14 H M of the previous figure shows: developing cusp, dental pulp (D), pseudostratified appearance of odontoblasts (O), predentin (Pd), dentin (d) enamel matrix (EM), ameloblasts (A), stratum intermedium (SI), stellate reticulum (SR) and dental sac (DS). 55

(H&E, orig.mag. x 200)

- 15 Shows: developing tooth in which crown formation is almost completed with cusps formation together with pulp tissue (P), odontoblasts (O), predentin (Pd), dentin (d), enamel matrix (EM), ameloblasts (A), stratum intermedium (SI), stellate reticulum (SR) and dental sac (DS). 56

Developing mandibular first molar of rat euthanized 7 days after birth of **study group b** (mothers received FA once the pregnancy was recognized).

(H&E, orig.mag. x 40)

- 16 H M of the previous figure shows: developing cusp tip, pulp tissue (P), pseudostratified odontoblasts, predentin (Pd), dentin (d), thin layer of enamel matrix (EM) and well-organized ameloblasts (A). Stratum intermedium (SI), stellate reticulum (SR), and dental sac (DS) are well seen. 57

(H&E, orig.mag. x 200)

- 17 Shows: developing tooth with a nearly completed crown residing in a bony crypt with well formed cusps, pulp tissue (P), odontoblasts (O), predentin (Pd), dentin (d), enamel matrix (EM), ameloblasts (A), stratum intermedium (SI), stellate reticulum (SR) and dental sac (DS). Enamel organ layers are reduced in size. 58

Developing mandibular first molar of rat euthanized 7 days after birth of **study group 2** (mothers received folic acid 7 days prior to caging).

(H&E, orig.mag. x 40)

- 18 H M of the previous figure shows: cusp formation, pulp tissue (P), well-organized pseudostratified odontoblasts (O), predentin (Pd), dentin (d), thick layer of enamel matrix (EM), well differentiated layer of ameloblasts (A), stratum intermedium (SI), stellate reticulum (SR), and dental sac (DS). Layers of enamel organ are reduced in size. 59

(H&E, orig.mag. x 200)



- 19 Shows erupting mandibular first molar with fully developed cusps, normal pulp (P) tissue, odontoblasts (O), predentin (Pd), dentin (d), enamel space (E) and reduced enamel epithelium (REE). Note: complete separation of roots (R), root trunk, interradicular bone (B), and periodontal ligament (PDL) formation are shown. 61  
Rat euthanized 18 days after birth of **control group**.  
(H&E, orig.mag. x 40)
- 20 Shows: dense pulp tissue (P), dense odontoblasts (O), predentin (Pd), dentin (d), enamel space (E) and reduced enamel epithelium (REE). Note: nearly erupting middle cusp, increased interradicular bone trabeculae (B) and proper arrangement of periodontal ligament (PDL) fibers are shown. 62  
Mandibular first molar of rat euthanized 18 days after birth of **study group c** (mothers received folic acid once the pregnancy was recognized).  
(H&E, orig.mag. x 40)
- 21 Shows: dense pulp tissue (P), increased density of odontoblasts (O), predentin (Pd), dentin (d), enamel space (E) and reduced enamel epithelium (REE). Also there is improved eruption of the cusp tips (the two mesial cusp tips are erupted), increased thickness of radicular dentin (d), increased density of the interradicular bone trabeculae (B) and increased the density of periodontal ligament (PDL) fibers during eruption with improved orientation. 63  
Mandibular first molar of rat euthanized 18 days after birth of **study group 3** (mothers received folic 7 days before caging).  
(H&E, orig.mag. x 40)
- 22 Shows: moderate RNA reaction of stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelial cells (IEE), odontoblasts (O) and dental papilla (Dp). Thin layer of predentin (Pd) is also seen. 67  
Developing mandibular first molar of rat euthanized immediately after birth (**control group**).  
(Methyl green pyronin, orig.mag. X 400)
- 23 Shows: increased enzymatic activity of RNA of stellate reticulum (SR), stratum intermedium (SI), differentiating inner enamel epithelial cells (IEE), odontoblasts (O) and dental papilla (Dp). Thin layer of predentin (Pd) is noticed. 68  
Developing mandibular first molar of rat euthanized