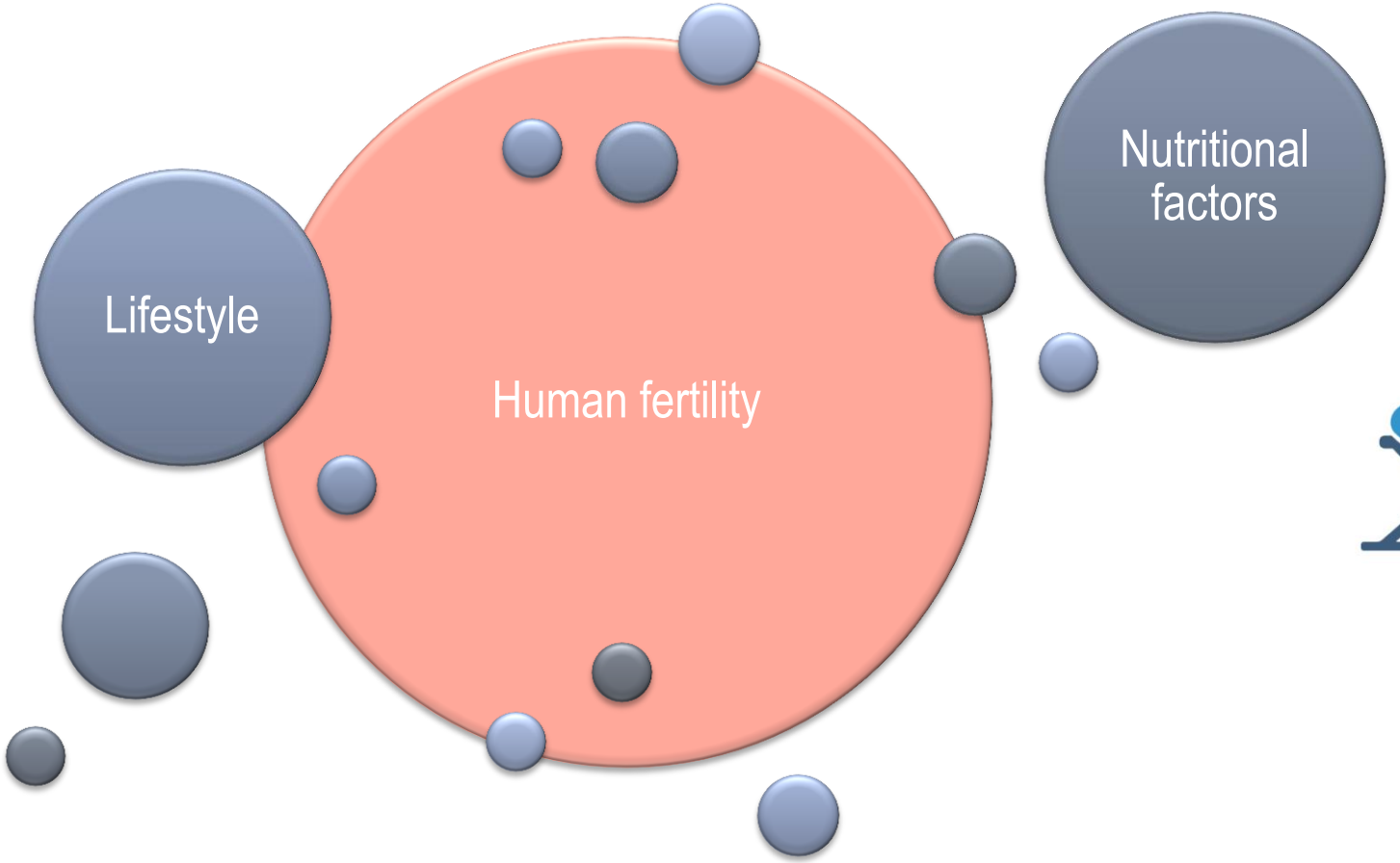
REDUCED OOCYTE QUALITY JUSTIFIES POOR ICSI OUTCOMES AMONG SMOKERS AND SUGAR CONSUMERS

Gabriela Halpern [1], Amanda Setti [1,2], Daniela Paes de Almeida Ferreira Braga [1,2], Assumpto Iaconelli Jr. [1,2], Edson Borges Jr. [1,2]

INTRODUCTION



Determinants of reproductive function

FERTILITY

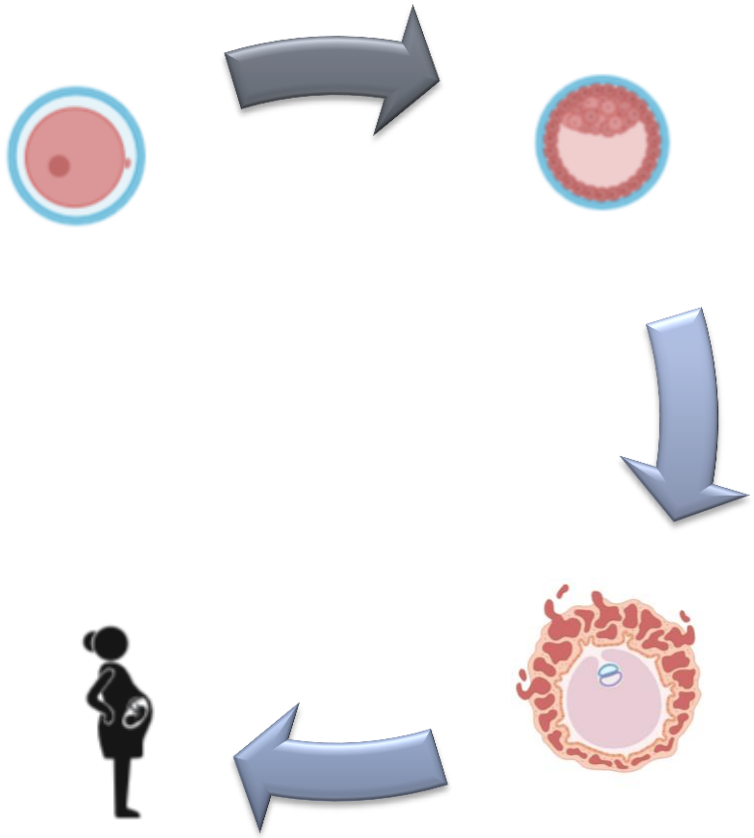
INTRODUCTION

Hypothesis

?

Oocyte dimorphisms

Reproductive outcomes



FERTILITY

OBJECTIVE

To investigate the impact of maternal lifestyle factors and nutritional habits on oocyte morphology and on the outcomes of ICSI cycles

MATERIAL AND METHODS

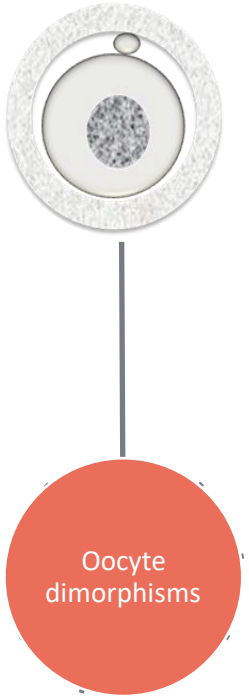
Prospective cohort study	Private-university affiliated IVF center
	561 couples, 1st ICSI cycle
	Jan/2015 – Dec/2018
	D5 ET
	> 4 and ≤ 20 retrieved oocytes
	> 5 x 10^6 spermatozoa / mL

Questionnaire

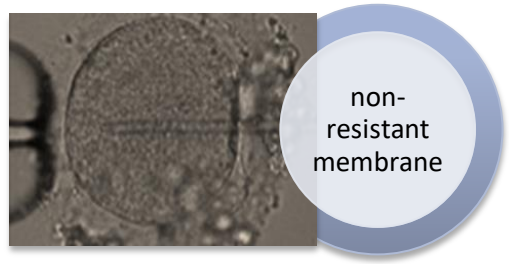
- Smoking habit
- Alcoholic beverages
- Refined sugar
- Artificial sweetener
- Soft drinks
- Legumes and vegetables
- Fruits
- Milk and dairy
- White and red meats
- Exercise frequency

FERTILITY

MATERIAL AND METHODS



- Centrally located cytoplasmic granulation (CLCG)
- Dark cytoplasm (DC)
- Vacuoles
- Smooth endoplasmic reticulum (SER)
- Large perivitelline space (PVS)
- PVS granularity
- Fragmented polar body (PB)
- Zona pellucida (ZP) abnormalities
- Shape abnormalities
- Membrane resistance (MR) abnormalities



MATERIAL AND METHODS

Data analysis	Multivariate regression analysis, adjusted for maternal age and BMI
	Lifestyle and nutritional factors: independent variables
	Incidence of oocyte dimorphisms and ICSI outcomes: dependent variables

RESULTS - Influence of lifestyle and nutrition on the incidence of oocyte dimorphisms

	Centrally located cytoplasmic granulation (CLCG)	Dark cytoplasm (DC)	Vacuole	Smooth endoplasmic reticulum (SER)	Perivitelline space (PVS) granularity	Fragmented polar body (PB)	Zona pellucida (ZP)	Shape	Membrane
Cigarette smoking	B: 41.2 CI: -13.1 – 95.5 p: 0.137	B: 2.1 CI: 1.0 – 3.3 p<0.001	B: 10.5 CI: -23.7 – 44.7 p: 0.548	B: 14.0 CI: 6.3 – 21.7 p<0.001	B: -15.8 CI: -42.4 – 10.9 p: 0.247	B: 32.4 CI: 7.9 – 57.0 p: 0.011	B: 14.9 CI: 3.9 – 25.9 p: 0.009	B: 14.2 CI: 4.6 – 23.8 p: 0.004	B: 28.3 CI: 9.9 – 46.6 p: 0.02
Alcoholic beverages	B: 8.84 CI: -12.2 – 29.8 p: 0.409	B: 2.14 CI: 1.3 – 3.0 p<0.001	B: -6.6 CI: -19.3 – 6.0 p: 0.302	B: 12.6 CI: 0.6 – 25.8 p: 0.040	B: 5.2 CI: -4.7 – 15.1 p: 0.307	B: 36.2 CI: 12.7 – 59.7 p: 0.003	B: 8.4 CI: 4.5 – 12.3 p<0.001	B: 1.0 CI: -3.0 – 5.0 p: 0.635	B: 0.6 CI: -2.1 – 3.2 p: 0.685
Refined sugar	B: 19.5 CI: 0.5 – 38.4 p: 0.044	B: 1.5 CI: 0.4 – 2.6 p: 0.008	B: -38.6 CI: -94.6 – 17.4 p: 0.177	B: -3.4 CI: -11.8 – 4.9 p: 0.420	B: 21.6 CI: 2.6 – 40.6 p: 0.027	B: 72.3 CI: 44.6 – 100.0 p<0.001	B: 3.7 CI: -10.9 – 18.3 p: 0.622	B: 1.5 CI: -0.3 – 3.3 p: 0.105	B: -1.7 CI: -4.2 – 0.8 p: 0.193
Artificial sweetener	B: 19.7 CI: 4.7 – 34.7 p: 0.010	B: 4.5 CI: 2.7 – 6.3 p<0.001	B: 1.6 CI: -76.1 – 79.3 p: 0.968	B: 22.1 CI: -35.9 – 80.1 p: 0.455	B: 44.0 CI: 3.8 – 84.2 p: 0.032	B: 89.1 CI: 30.6 – 147.6 p: 0.003	B: -4.9 CI: -35.8 – 25.9 p: 0.754	B: 1.3 CI: 0.3 – 2.6 p: 0.044	B: 21.6 CI: 14.1 – 29.1 p<0.001
Milk and dairy	B: -29.3 CI: -80.6 – 21.9 p: 0.262	B: -0.8 CI: -3.2 – 1.6 p: 0.504	B: 19.1 CI: -73.1 – 111.3 p: 0.685	B: 5.2 CI: -5.5 – 15.9 p: 0.341	B: 40.2 CI: -20.4 – 100.8 p: 0.194	B: -26.4 CI: -51.2 - -1.5 p: 0.038	B: - 24.4 CI: -48.5 - -0.328 p: 0.047	B: -12.4 CI: -15.4 - -9.4 p: 0.004	B: -5.3 CI: -10.2 - -0.5 p: 0.03
Legumes and vegetables	B: -79,4 CI: -132.4 - -26.4 p: 0.003	B: -2.8 CI: -4.4 - -1.2 p: 0.001	B: -76.3 CI: -162.9 – -0.2 p: 0.047	B: -24.0 CI: -38.2 - -9.8 p: 0.001	B: -21.6 CI: -78.5 – 35.3 p: 0.457	B: 11.3 CI: -31.5 – 54.1 p: 0.605	B: 14.4 CI: -8.1 – 37.0 p: 0.210	B: 2.0 CI: -1.2 – 5.2 p: 0.220	B: -26.2 CI: -42.2 - -10.1 p: 0.001
Fish	B: - 3.6 CI: -32.2 – 25.0 p: 0.806	B: -0.7 CI: -4.6 - -3.2 p: 0.741	B: 37.5 CI: -22.2 – 97.1 p: 0.218	B: 4.6 CI: -2.6 – 11.8 p: 0.215	B: -16.7 CI: -55.9 – 22.5 p: 0.404	B: -11.8 CI: -45.2 – 21.6 p: 0.489	B: -4.8 CI: -20.4 – 10.7 p: 0.544	B: -0.7 CI: -2.7 – 1.2 p: 0.447	B: -8.7 CI: -16.4 - -1.0 p: 0.027
Physical activity	B: -0.1 CI: -44.8 – 44.6 p: 0.996	B: -3.5 CI: -4.8 - -2.1 p: <0.001	B: -24.2 CI: -95.2 – 46.7 p: 0.504	B: 6.0 CI: -5.5 – 17.4 p: 0.306	B: 9.4 CI: -37.2 – 56.0 p: 0.693	B: -35.2 CI: -70.4 - -0.1 p: 0.049	B: 3.9 CI: -14.6 – 22.4 p: 0.680	B: 1.9 CI: -4.1 – 7.9 p: 0.530	B: 9.3 CI: -4.7 – 23.4 p: 0.194

RESULTS

Comparison of oocyte dimorphisms' incidence amongst non-smoker and smokers, according to self-reported frequency

Outcomes	Smoking habit				
	Non-smoker (n= 407)	Up to 5 cigarettes/day (n= 66)	Between 5 and 10 cigarettes/day (n= 50)	More than 10 cigarettes/day (n= 38)	p-value
DC	0.0 ± 0.0 [a]	0.0 ± 0.0 [a]	1.5 ± 0.1 [b]	2.5 ± 0.2 [c]	<0.001
Fragmented PB	14.4 ± 0.8 [a]	28.4 ± 0.3 [b]	34.1 ± 1.0 [c]	50.0 ± 7.1 [c]	<0.001
ZP abnormality	0.0 ± 0.0 [a]	4.4 ± 0.1 [b]	3.9 ± 0.3 [b]	9.7 ± 0.4 [c]	<0.001
MR abnormality	0.0 ± 0.0 [a]	1.3 ± 0.2 [b]	2.1 ± 0.2 [c]	3.5 ± 0.1 [d]	<0.001

RESULTS

Comparison of oocyte dimorphisms' incidence amongst refined sugar's non-consumers and consumers, according to self-reported frequency

Outcomes	Refined sugar consumption				
	Non-consumer (n= 77)	Up to 2x/week (n= 236)	Between 3x and 6x/week (n= 47)	More than 6x/week (n=201)	p-value
CLCG	0.0 ± 0.0 [a]	1.9 ± 0.2 [b]	7.5 ± 0.2 [c]	8.6 ± 0.2 [d]	<0.001
DC	0.0 ± 0.0 [a]	0.6 ± 0.1 [b]	2.9 ± 0.1 [c]	2.9 ± 0.4 [c]	<0.001
Fragmented PB	21.9 ± 0.7 [a]	27.1 ± 0.5 [b]	31.1 ± 0.4 [c]	33.9 ± 1.9 [c]	<0.001

RESULTS - Influence of lifestyle and nutrition on the outcomes of ICSI

Predictor variables	Retrieved oocytes	Mature oocyte rate	Fertilization rate	Blastocyst development	High-quality blastocysts	Implantation rate	Pregnancy rate	Miscarriage rate
Cigarette smoking	B: -0.7 CI: -1.1 - -0.3 p<0.001	B: 3.9 CI: -19.1 – 27.0 p: 0.734	B: -11.8 CI: -23.2 - -0.3 p: 0.044	B: -79.8 CI: -141.0 - -18.6 p: 0.011	B: -31.0 CI: -77.6 – -15.6 p<0.001	B: -0.8 CI: -1.1 - -0.5 p<0.001	OR: 0.8 CI: 0.7 – 0.9 p: 0.007	OR: 2.5 CI: 1.8 – 5.6 p: 0.013
Alcoholic beverages	B: -1.5 CI: -2.0 - -1.2 p<0.001	B: -1.1 CI: -9.3 – 7.0 p: 0.783	B: -2.5 CI: -11.1 – 6.1 p: 0.575	B: 2.7 CI: -5.8 – 11.1 p: 0.536	B: -3.7 CI: -17.9 – 10.4 p: 0.605	B: -0.2 CI: -0.2 - -0.1 p<0.001	OR: 0.5 CI: 0.09 – 3.1 p: 0.484	OR: 1.8 CI: 0.3 – 9.5 p: 0.479
Refined sugar	B: -9.0 CI: -12.8 - -5.3 p<0.001	B: -7.2 CI: -18.6 – 4.2 p: 0.215	B: -25.7 CI: -46.0 - -5.3 p: 0.013	B: -32.9 CI: -63.5 - -2.4 p: 0.035	B: -17.8 CI: -58.1 – 22.5 p: 0.387	B: -0.9 CI: -1.0 - -0.8 p<0.001	OR: 0.07 CI: 0.006 - 0.9 p: 0.045	OR: 2.0 CI: 0.1 – 36.3 p: 0.639
Artificial sweetener	B: -22.7 CI: -29.2 - -16.2 p<0.001	B: -0.2 CI: -1.4 – 0.9 p: 0.698	B: -36.2 CI: -70.2 - -2.2 p: 0.037	B: 8.7 CI: -3.6 – 21.2 p: 0.167	B: -12.7 CI: -56.3 – 30.9 p: 0.567	B: -0.3 CI: -0.4 - -0.1 p<0.001	OR: 0.6 CI: 0.2 – 1.5 p: 0.252	OR: 17.1 CI: 0.2 – 1216.4 p: 0.191
Fruits	B: 7.5 CI: 2.9 – 12.1 p: 0.001	B: -17.7 CI: -56.9 – 21.5 p: 0.375	B: -3.2 CI: -30.4 – 24.0 p: 0.818	B: -20.7 CI: -65.3 – 23.8 p: 0.362	B: -14.7 CI: -47.1 – 17.6 p: 0.372	B: -1.2 CI: -17.0 – 14.6 p: 0.885	OR: 0.8 CI: 0.5 – 1.4 p: 0.507	OR: 0.2 CI: 0.04 – 1.5 p: 0.123
Legumes and vegetables	B: 11.8 CI: 5.4 – 18.1 p<0.001	B: 56.4 CI: 14.0 – 98.7 p: 0.009	B: 9.2 CI: -25.1 – 43.6 p: 0.598	B: 27.6 CI: -22.1 – 77.3 p: 0.277	B: 18.6 CI: -19.3 – 56.5 p: 0.336	B: 12.4 CI: 2.7 – 22.1 p: 0.013	OR: 2.4 CI: 1.1 – 5.2 p: 0.028	OR: 0.7 CI: 0.2 – 1.8 p: 0.423
Physical activity	B: 10.2 CI: 5.4 – 15.0 p<0.001	B: -5.1 CI: -39.1 – 28.8 p: 0.767	B: 8.5 CI: -16.7 – 33.7 p: 0.510	B: 44.03 CI: 25.89 - -6.7 p: 0.089	B: 18.2 CI: -1.1 – 37.5 p: 0.064	B: 0.03 CI: -0.07 – 0.1 p: 0.528	OR: 1.9 CI: 0.6 – 5.9 p: 0.282	OR: 1.1 CI: 0.1 – 9.9 p: 0.916

FERTILITY

RESULTS

Comparison of ICSI outcomes amongst non-smoker and smokers, according to self-reported frequency

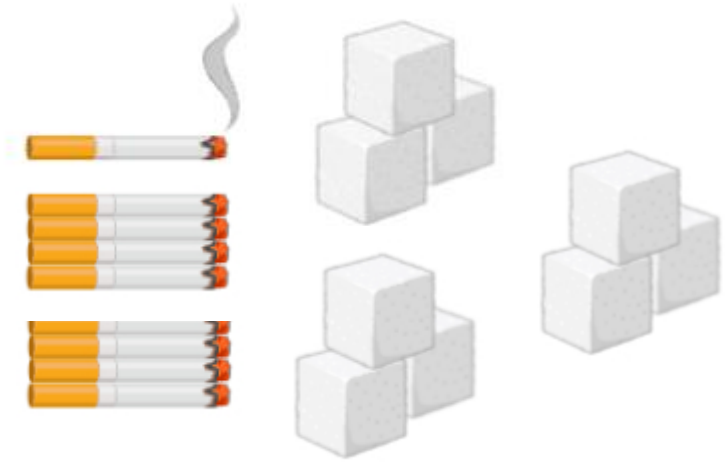
Outcomes	Smoking habit				
	Non-smoker (n= 407)	Up to 5 cigarettes/day (n= 66)	Between 5 and 10 cigarettes/day (n= 50)	More than 10 cigarettes/day (n= 38)	p-value
Fertilization rate	83.7 ± 1.9 [a]	74.6 ± 0.5 [b]	71.5 ± 1.4 [b]	60.0 ± 0.7 [c]	<0.001
Implantation rate	33.3 ± 3.3 [a]	20.1 ± 0.2 [b]	17.5 ± 0.5 [c]	15.1 ± 0.6 [d]	<0.001

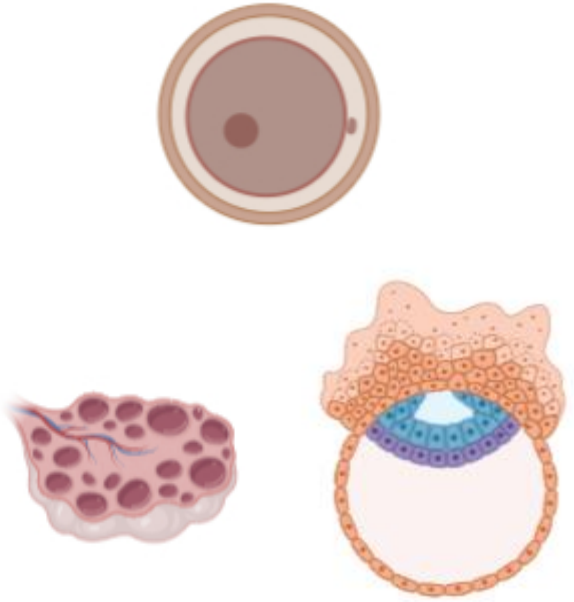
RESULTS

Comparison of ICSI outcomes amongst refined sugar's non-consumers and consumers, according to self-reported frequency

Outcomes	Refined sugar consumption				
	Non-consumer (n= 77)	Up to 2x/week (n= 236)	Between 3x and 6x/week (n= 47)	More than 6x/week (n=201)	p-value
Fertilization rate	80.4 ± 1.4 [a]	78.3 ± 0.8 [a]	71.9 ± 3.0 [b]	61.1 ± 0.7 [b]	<0.001
Implantation rate	25.7 ± 0.6 [a]	18.7 ± 0.3 [b]	20.0 ± 1.0 [b]	15.3 ± 0.3 [c]	<0.001

COMMENTS



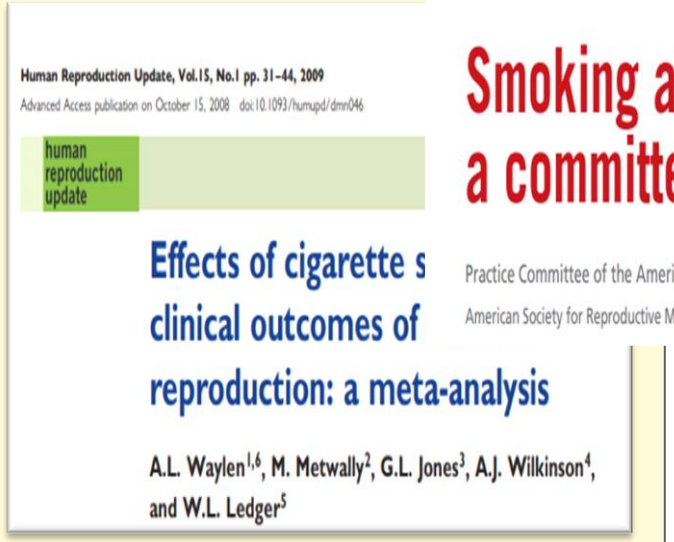


FERTILITY

Exposed x Non-exposed

COMMENTS

Background – Maternal smoking habit



Meta-analysis of 21 studies

45% ↓CPR, LBR, ↑MR

Smoking habit should be discouraged;

Clinicians should provide support to ease smoking cessation.

Earlier onset of menopause, one year delay in time to pregnancy, 60% increase in the odds of female infertility

FERTILITY

COMMENTS

Background – Maternal nutrition

frontiers in Public Health

MINI REVIEW
published: 31 July 2018
doi: 10.3389/fpubh.2018.00211

Check for updates

The Influence of Diet on Fertility and the Implications for Public Health Nutrition in the United States

FERTILITY

COMMENTS

Background – Maternal nutrition

Sun *et al. Reproductive Biology and Endocrinology* (2019) 17:73
https://doi.org/10.1186/s12958-019-0520-9

Reproductive Biology and Endocrinology

RESEARCH Open Access

Mediterranean diet improves embryo yield in IVF: a prospective cohort study

Hongmei Sun†, Yihua Lin†, Dongxia Lin, Change Zou, Xiangli Zou, Lan Fu, Fanhua Meng and Weiping Qian*

FERTILITY

COMMENTS

Background – Maternal nutrition

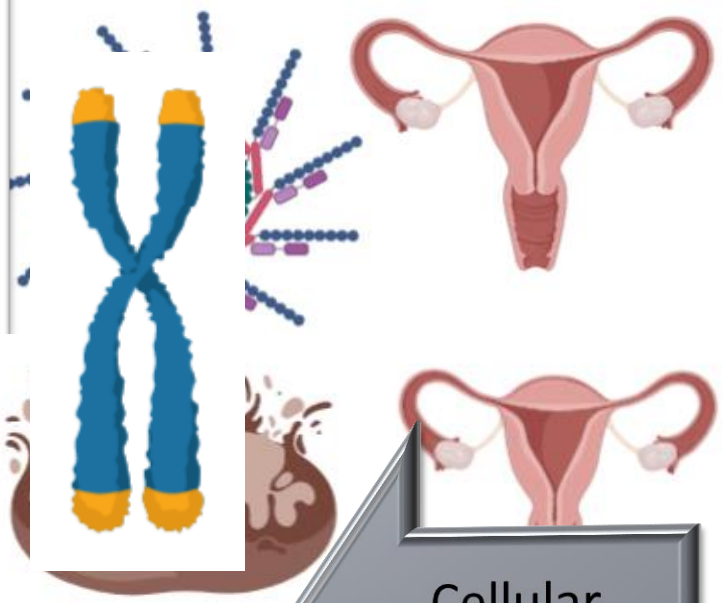
Molecular Human Rep
Advanced Access publicatio
MHR

ORIGINAL ARTICLE
Endocrine Research

Telomere length as a marker of cellular ageing is associated with prevalence and progression of metabolic syndrome

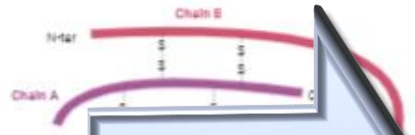
Dóra Révész, MSc, Yuri Milaneschi, PhD, Josine E. V
Brenda W.J.H. Penninx, PhD

Robyn A. North[4], Lesley M.E. McCowan[5], and Claire T. Rober
behalf of the SCOPE Consortium



Shortening of telomeres

Cellular ageing



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Johns Hopkins University Bloomberg School o

Vol. 154, No. 6
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Maternal Gluco Concentration Influences Fetal Gro , Gestation, and Pregnancy Con plications

Theresa O. Scholl,[1] MaryFran Sowers,[2] Xinhua Chen,[1] and Carine Lenders[3]

FERTILITY

COMMENTS

Background – Maternal nutrition

RBM ONLINE

ELSEVIER

Article

Is there an association between artificial sweetener consumption and assisted reproduction outcomes?

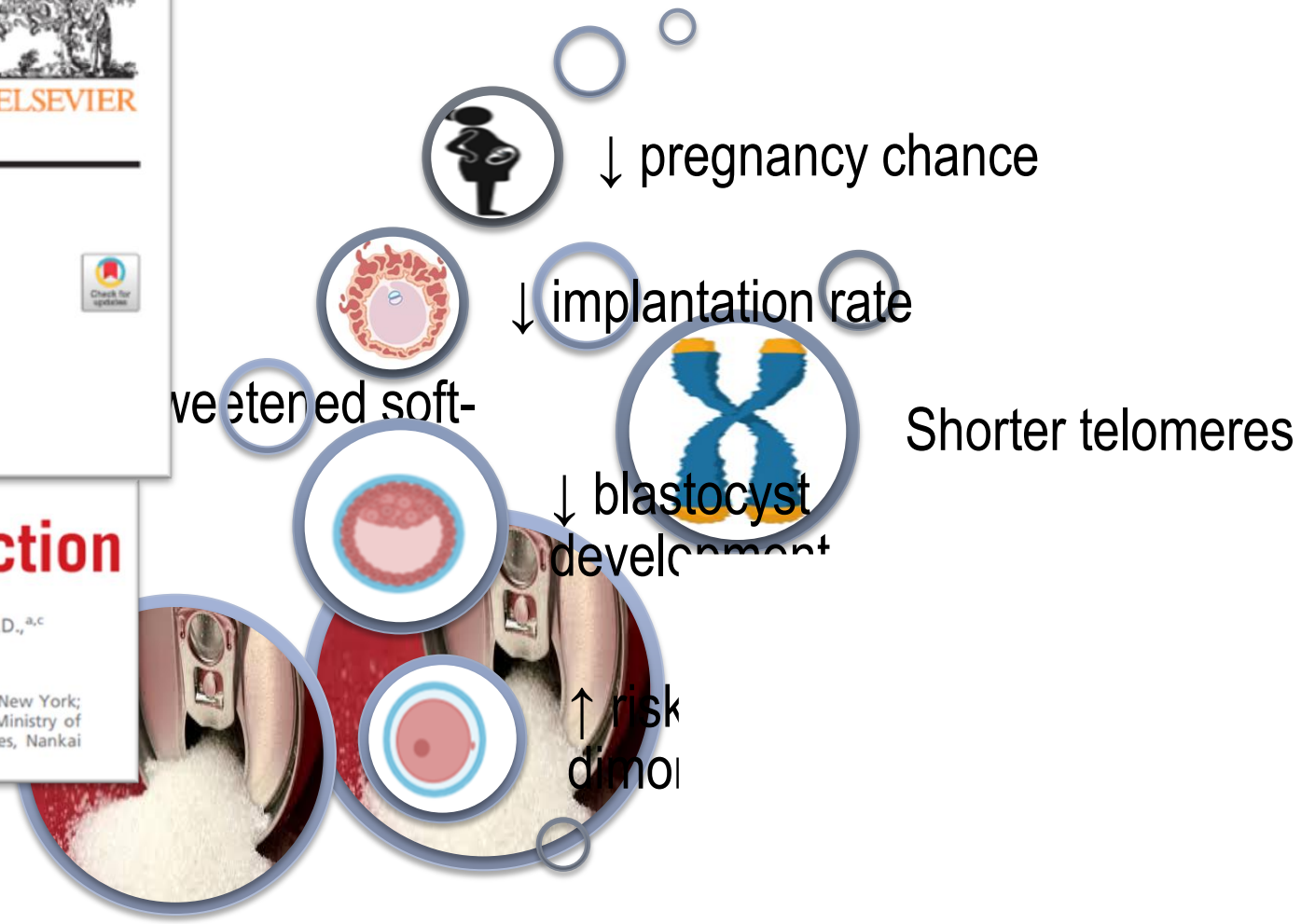
Amanda Souza Setti [a,b], Daniela Paes de Almeida Ferreira Braga [a,b], Gabriela Halpern [a], Rita de Cássia S Figueira [a], Assumpto Iaconelli Jr [a], Edson Borges Jr [a,b,]*

Telomeres and human reproduction

Keri Horan Kalmbach, M.S.,[a] Danielle Mota Fontes Antunes, M.S.,[a,b] Roberta Caetano Dracxler, M.D.,[a,c] Taylor Warner Knier, B.A.,[a] Michelle Louise Seth-Smith, B.S.,[a] Fang Wang, Ph.D.,[a] Lin Liu, Ph.D.,[d] and David Lawrence Keefe, M.D.[a]

[a] Department of Obstetrics and Gynecology, New York University, Langone Medical Center, New York City, New York; [b] Graduate Program in Pathology, Fluminense Federal University, Rio de Janeiro, and CAPES Foundation, Ministry of Education of Brazil, Brasilia, Brazil; [c] São Paulo University, São Paulo, Brazil; and [d] College of Life Sciences, Nankai University, Tianjin, People's Republic of China

FERTILITY



COMMENTS

Strengths and limitations

- Novelty
- Casuistic

FERTILITY

CONCLUSION

Maternal lifestyle factors and nutritional habits, mainly cigarette smoking and the consumption of refined sugar, appear to reduce oocyte quality and the outcomes of ICSI