XXIII Congresso Brasileiro de
Reprodução Assistida
31 de julho a 03 de agosto de 2019
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CONGRESSO REDLARA • REGIÃO BRASIL 2019
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31 JULHO 2019 • EXPOUNIMED CURITIBA

Red Latinoamericana de Reproducción Asistida

Fragmentação do DNA espermático elevada: O que fazer?

Edson Borges Jr.

FERTILITY MEDICAL GROUP
FERTILITY

Declaração:

Declaro o recebimento de honorários para palestras e/ou ensaios clínicos da Merck, Ferring e Abbott (não relacionados ao assunto desta palestra).

Nenhum outro conflito de interesse para divulgar.

Resolução do Conselho Federal de Medicina nº 1.595/2.000

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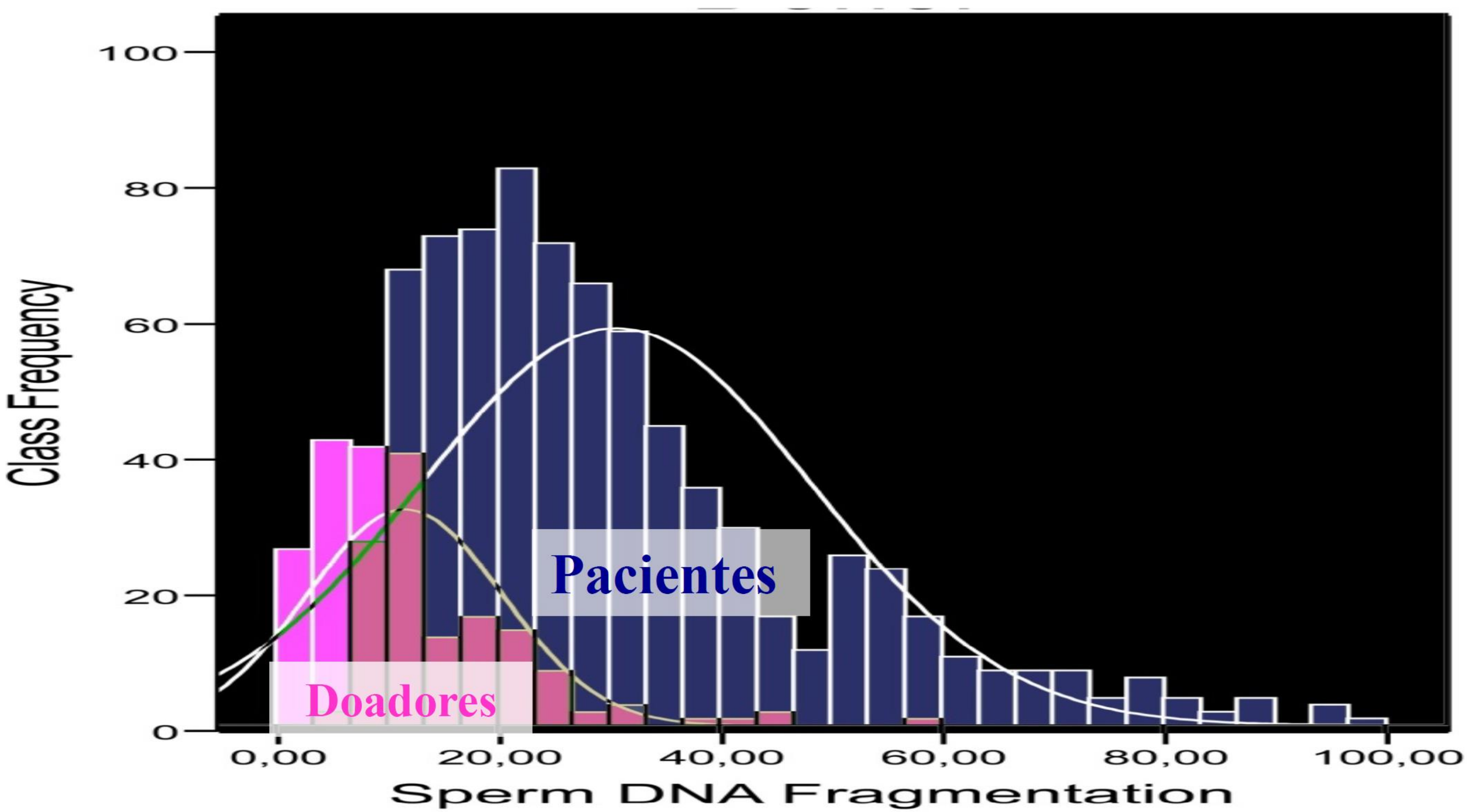
Taxa de Fragmentação do DNA espermático



Gosalvez et al. J *Reprod Biotechnol Fertil.* 2015

FERTILITY

Reproductive BioMedicine Online (2015) **30**, 120–127

ELSEVIER

www.sciencedirect.com
www.rbmonline.com

REVIEW

The effect of sperm DNA fragmentation on live birth rate after IVF or ICSI: a systematic review and meta-analysis

CrossMark

A Osman *, H Alsomait, S Seshadri, T El-Toukhy, Y Khalaf

Assisted Conception Unit, Guys Hospital, Great Maze Pond, SE1 9RT, UK

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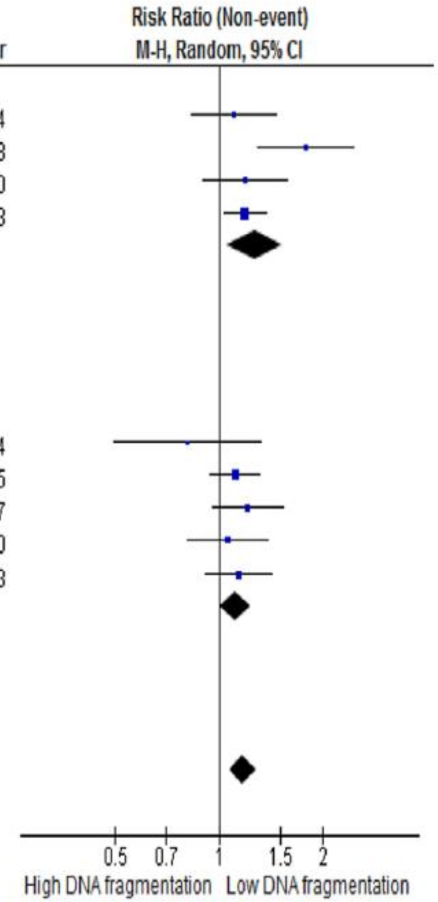
Study or Subgroup	High DNA fragmentation Events	High DNA fragmentation Total	Low DNA fragmentation Events	Low DNA fragmentation Total	Weight	Risk Ratio (Non-event) M-H, Random, 95% CI	Year
6.2.1 IVF							
Bungum *et al., 2004*	4	18	27	91	8.4%	1.11 [0.84, 1.46]	2004
Frydman *et al., 2008*	12	52	37	65	6.9%	1.79 [1.30, 2.45]	2008
Speyer *et al., 2010*	1	8	31	116	8.3%	1.19 [0.90, 1.59]	2010
Simon *et al., 2013*	13	99	28	104	22.6%	1.19 [1.03, 1.37]	2013
Subtotal (95% CI)		**177**		**376**	**46.1%**	**1.27 [1.05, 1.52]**	
Total events	30		123				
Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 6.79$, df = 3 (P = 0.08); $I^2 = 56\%$							
Test for overall effect: Z = 2.52 (P = 0.01)							
6.2.2 ICSI							
Bungum *et al., 2004*	8	17	17	49	3.1%	0.81 [0.50, 1.33]	2004
Check *et al., 2005*	3	29	15	77	18.4%	1.11 [0.94, 1.31]	2005
Ozmen *et al., 2007*	0	8	7	33	10.9%	1.21 [0.95, 1.54]	2007
Speyer *et al., 2010*	5	22	20	74	9.2%	1.06 [0.81, 1.38]	2010
Simon *et al., 2013*	19	93	13	43	12.2%	1.14 [0.91, 1.42]	2013
Subtotal (95% CI)		**169**		**276**	**53.9%**	**1.11 [1.00, 1.23]**	
Total events	35		72				
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.56$, df = 4 (P = 0.63); $I^2 = 0\%$							
Test for overall effect: Z = 2.02 (P = 0.04)							
Total (95% CI)		**346**		**652**	**100.0%**	**1.17 [1.07, 1.28]**	
Total events	65		195				
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 10.37$, df = 8 (P = 0.24); $I^2 = 23\%$							
Test for overall effect: Z = 3.46 (P = 0.0005)							
Test for subgroup differences: $Chi^2 = 1.45$, df = 1 (P = 0.23), $I^2 = 31.2\%$							



Live birth rate in high and low sperm DNA fragmentation groups. ICSI = intracytoplasmic sperm injection.

FERTILITY

Asian Journal of Andrology (2017) 19, 80–90

www.asiaandro.com; www.ajandrology.com

Open Access

ORIGINAL ARTICLE

Sperm Biology

A systematic review and meta-analysis to determine the effect of sperm DNA damage on *in vitro* fertilization and intracytoplasmic sperm injection outcome

Luke Simon[1,*], Armand Zini[2,*], Alina Dyachenko[2], Antonio Ciampi[2], Douglas T Carrell[1,3,4]

Table 3: Meta-analysis summary: Overall and subgroup odds ratios of studies on sperm DNA damage and pregnancy

Effect	*Number of studies*	*Fixed effects model*		*Random effects model*	
		OR (95% CI)	*P*	*OR (95% CI)*	*P*
Overall effect	56	1.68 (1.49–1.89)	0.0000*	1.84 (1.5–2.27)	<0.0001*
Sperm DNA damage assays					
SCSA	23	1.18 (0.96–1.44)	0.1115	1.22 (0.93–1.61)	0.1522
TUNEL	18	2.18 (1.75–2.72)	0.0000*	2.22 (1.61–3.05)	<0.0001*
Comet	7	3.34 (2.32–4.82)	0.0000*	3.56 (1.78–7.09)	0.0003*
SCD	8	1.51 (1.18–1.92)	0.0011*	1.98 (1.19–3.3)	0.0086*
Types of assisted treatment					
IVF	16	1.65 (1.34–2.04)	0.0000*	1.92 (1.33–2.77)	0.0005*
ICSI	24	1.31 (1.08–1.59)	0.0068*	1.49 (1.11–2.01)	0.0075*
Mixed	16	2.37 (1.89–2.97)	0.0000*	2.32 (1.54–3.5)	0.0001*

Asian Journal of Andrology (2017) 19, 80–90

Sperm DNA fragmentation and recurrent pregnancy loss: a systematic review and meta-analysis

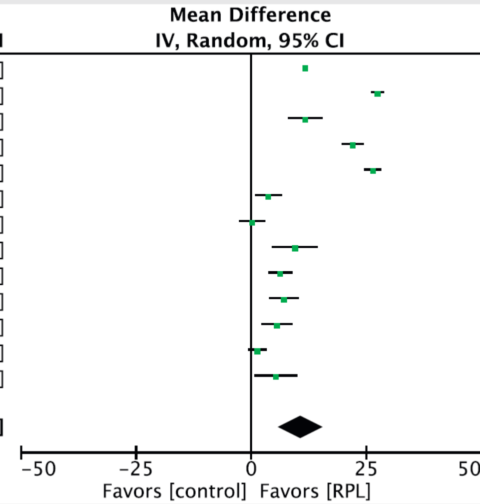
Dana B. McQueen, M.D., M.A.S., John Zhang, Ph.D., and Jared C. Robins, M.D.

Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Northwestern University, Chicago, Illinois

Study or Subgroup	Recurrent Pregnancy Loss Mean	SD	Total	Fertile Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Absalan 2012	23.3	1.1	30	11.6	0.5	30	7.9%	11.70 [11.27, 12.13]
Bareh 2016	36.8	2.7	26	9.4	2.7	31	7.9%	27.40 [25.99, 28.81]
Bhattachara 2008	18.1	16.1	74	6.4	3.6	65	7.6%	11.70 [7.93, 15.47]
Brahem 2011	32.2	6.1	31	10.2	2.1	20	7.8%	22.00 [19.66, 24.34]
Carrell 2003	38.3	4.2	21	11.9	1	26	7.8%	26.40 [24.56, 28.24]
Coughlan 2014	10.9	1.9	16	7.2	3.7	7	7.7%	3.70 [0.81, 6.59]
Esquerre-Lamare 2018	6.8	5.6	33	6.6	5.5	27	7.7%	0.20 [−2.62, 3.02]
Imam 2011	23.4	9.9	20	13.9	5.4	20	7.3%	9.50 [4.56, 14.44]
Kumar 2012	28.1	5	45	21.8	4.8	20	7.8%	6.30 [3.74, 8.86]
Ribas 2012	19.3	6.1	20	12.2	4.6	25	7.7%	7.10 [3.88, 10.32]
Ruixue 2013	25.6	11.5	68	20	7.7	63	7.6%	5.60 [2.27, 8.93]
Zhang 2012	15.2	6.4	111	13.9	4.4	30	7.8%	1.30 [−0.67, 3.27]
Zidi-Jrah 2016	17.1	9.3	22	11.8	5.7	20	7.4%	5.30 [0.68, 9.92]
Total (95% CI)			**517**			**384**	**100.0%**	**10.70 [5.82, 15.58]**

Heterogeneity: $Tau^2 = 78.10$, $Chi^2 = 1019.62$, df = 12 ($P < 0.00001$); $I^2 = 99\%$

Test for overall effect: $Z = 4.30$ ($P < 0.0001$)



Primary outcome in overall analysis.

McQueen. Sperm DNA fragmentation and RPL. Fertil Steril 2019.

Fertility and Sterility® Vol. 112, No. 1, July 2019

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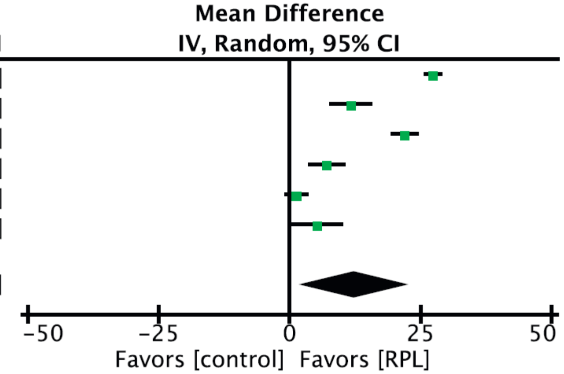
Recurrent pregnancy loss as 2 or more losses

Study or Subgroup	Recurrent Pregnancy Loss Mean	SD	Total	Fertile Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Bareh 2016	36.8	2.7	26	9.4	2.7	31	16.9%	27.40 [25.99, 28.81]
Bhattachara	18.1	16.1	74	6.4	3.6	65	16.5%	11.70 [7.93, 15.47]
Brahem 2011	32.2	6.1	31	10.2	2.1	20	16.8%	22.00 [19.66, 24.34]
Ribas 2012	19.3	6.1	20	12.2	4.6	25	16.6%	7.10 [3.88, 10.32]
Zhang 2012	15.2	6.4	111	13.9	4.4	30	16.8%	1.30 [−0.67, 3.27]
Zidi–Jrah 2016	17.1	9.3	22	11.8	5.7	20	16.4%	5.30 [0.68, 9.92]
Total (95% CI)			**284**			**191**	**100.0%**	**12.51 [2.14, 22.89]**

Heterogeneity: $Tau^2 = 165.76$; $Chi^2 = 538.60$, df = 5 (P < 0.00001); $I^2 = 99\%$

Test for overall effect: Z = 2.36 (P = 0.02)

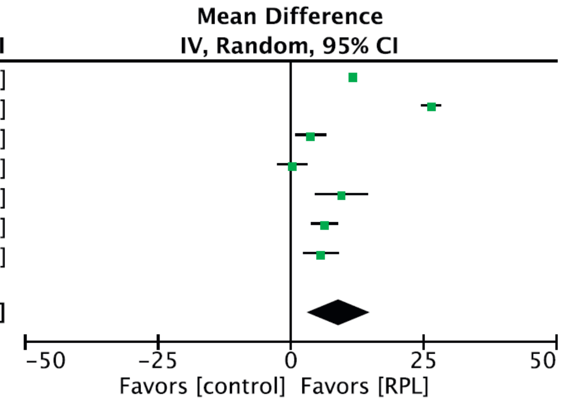


Recurrent pregnancy loss as 3 or more losses

Study or Subgroup	Recurrent Pregnancy Loss Mean	SD	Total	Fertile Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Absalan 2012	23.3	1.1	30	11.6	0.5	30	14.8%	11.70 [11.27, 12.13]
Carrell 2003	38.3	4.2	21	11.9	1	26	14.6%	26.40 [24.56, 28.24]
Coughlan 2014	10.9	1.9	16	7.2	3.7	7	14.3%	3.70 [0.81, 6.59]
Esquerre–Lamare 2018	6.8	5.6	33	6.6	5.5	27	14.3%	0.20 [−2.62, 3.02]
Imam 2011	23.4	9.9	20	13.9	5.4	20	13.4%	9.50 [4.56, 14.44]
Kumar 2012	28.1	5	45	21.8	4.8	20	14.4%	6.30 [3.74, 8.86]
Ruixue 2013	25.6	11.5	68	20	7.7	63	14.1%	5.60 [2.27, 8.93]
Total (95% CI)			**233**			**193**	**100.0%**	**9.12 [3.16, 15.08]**

Heterogeneity: $Tau^2 = 62.49$; $Chi^2 = 369.78$, df = 6 (P < 0.00001); $I^2 = 98\%$

Test for overall effect: Z = 3.00 (P = 0.003)



Subgroup analysis by definition of recurrent pregnancy loss (RPL).

McQueen. Sperm DNA fragmentation and RPL. Fertil Steril 2019.

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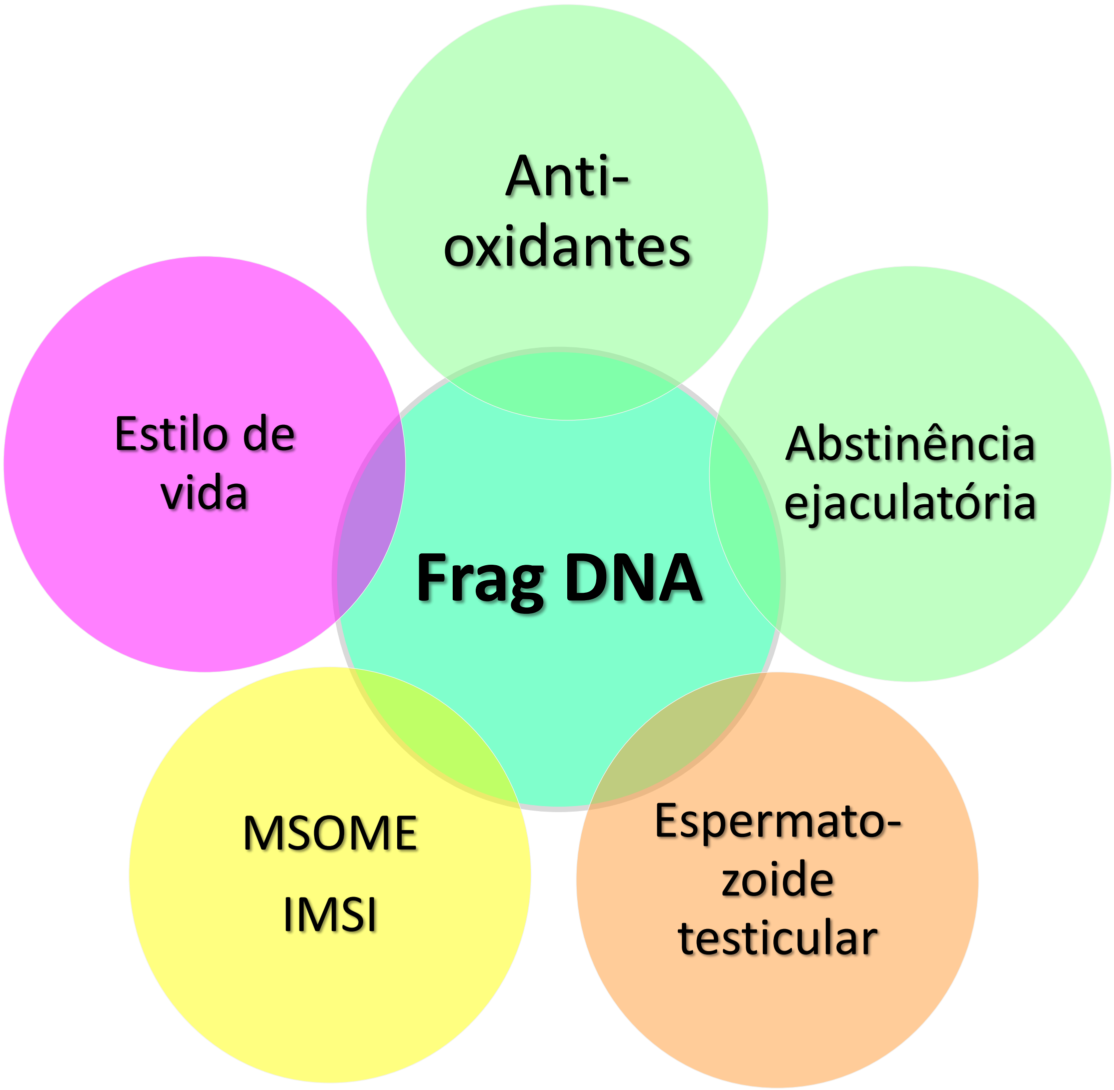
Anti-
oxidantes
Estilo de
vida
Abstinência
ejaculatória
Frag DNA
MSOME
IMSI
Espermato-
zoide
testicular

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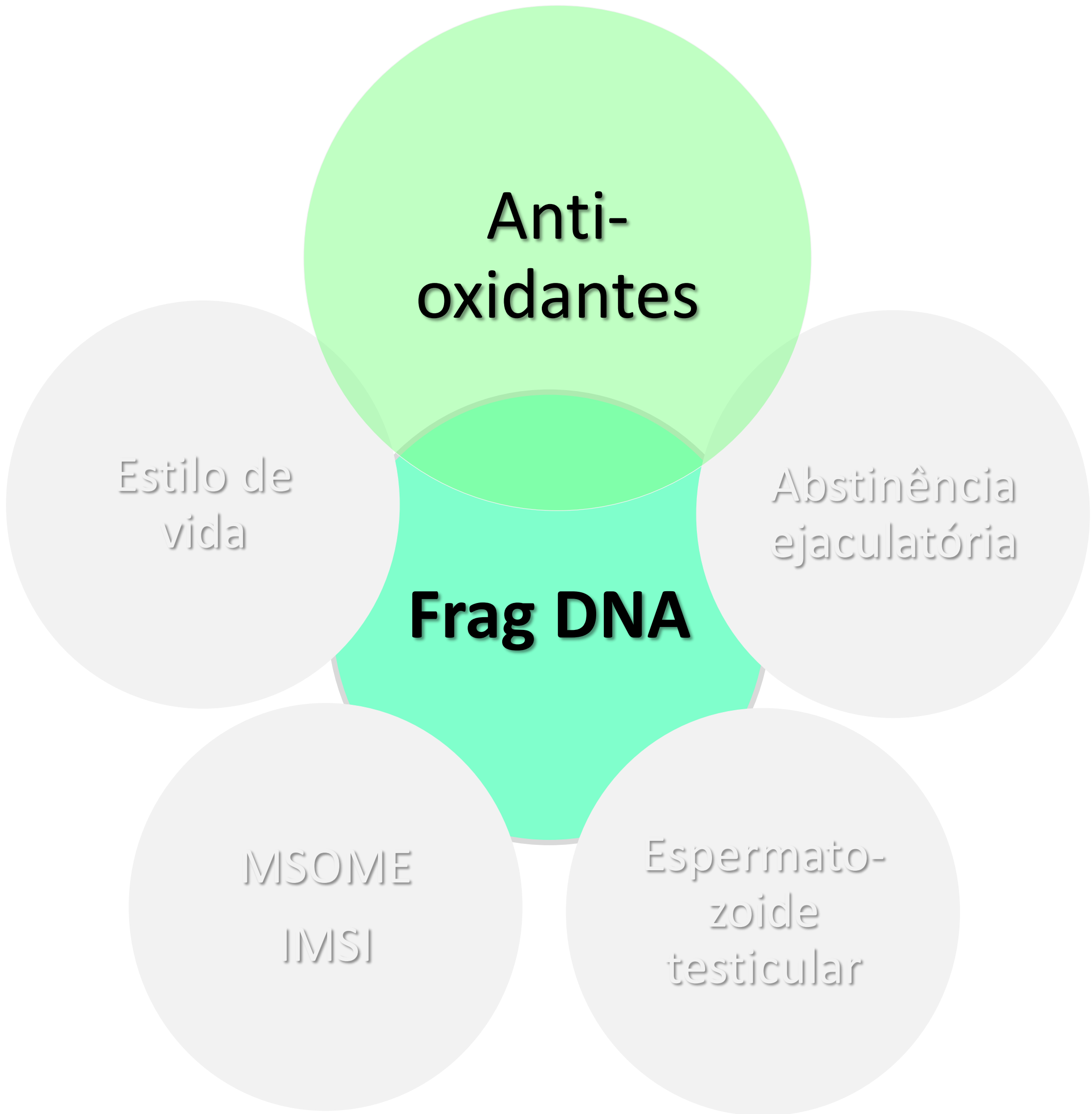
Anti-
oxidantes
Frag DNA
Estilo de vida
Abstinência ejaculatória
MSOME
IMSI
Espermato-zoide testicular

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COCHRANE SUMMARIES

Independent high-quality evidence for health care decision making

Antioxidants for male subfertility

Showell MG, Brown J, Yazdani A, Stankiewicz MT, Hart RJ

Published Online: March 14, 2012

Oxidative stress may cause sperm cell damage. This damage can be reduced by the body's own natural antioxidant defences. Antioxidants can be part of our diet and taken as a supplement. It is believed that in many cases of unexplained subfertility, and also in instances where there may be a sperm-related problem, taking an oral antioxidant supplement may increase a couple's chance of conceiving when undergoing fertility treatment. This review identified 34 randomised controlled trials involving 2876 couples. Pooled findings from three small trials suggest an increase in live birth rates for the partners of subfertile men taking an antioxidant supplement as part of an assisted reproductive program. However, further well-designed large randomised placebo-controlled trials are needed to confirm these findings.

- 34 estudos randomizados – 2.876 casais
- Aumento da taxa gestação (OR=4,18)
- Aumento na taxa de nascidos vivos (OR=4,85)

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Cochrane Library
Cochrane Database of Systematic Reviews

Cochrane Database of Systematic Reviews 2019, Issue 3. Art. No.: CD007411.

Antioxidants for male subfertility (Review)

Smits RM, Mackenzie-Proctor R, Yazdani A, Stankiewicz MT, Jordan V, Showell MG

- 61 estudos com uma população total de 6.264 homens subférteis, com idades entre 18 e 65 anos, combinaram 18 diferentes antioxidantes orais.

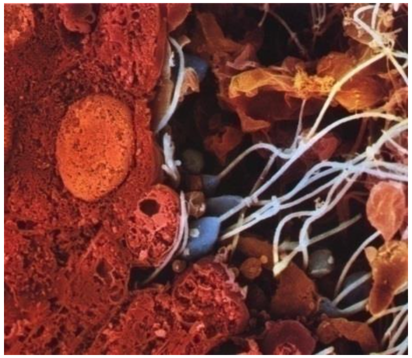
- **Nascidos vivos:** ***OR 1.79***, 95% CI 1.20 to 2.67, P = 0.005, 7 RCTs, 750 homens

- **Gestação clínica:** ***OR 2.97***, 95% CI 1.91 to 4.63, P < 0.0001, 11 RCTs, 786 homens

FERTILITY

Antioxidantes orais – como prescrever

- Vitamina C: 500 mg/dia
- Vitamina E: 400 mg/dia
- Ácido fólico (folato): 2-5 mg/dia
- Zinco: 25 mg/dia
- Selênio: 26 mg/dia
- L-carnitina: 3g/dia



65 dias – tempo da espermatogênese

FERTILITY

Anti-
oxidantes
Estilo de
vida
Frag DNA
Abstinência
ejaculatória
MSOME
IMSI
Espermato-
zoide
testicular

FERTILITY

ANDROLOGY

ISSN: 2047-2919

ANDROLOGY

ORIGINAL ARTICLE

Revisiting the impact of ejaculatory abstinence on semen quality and intracytoplasmic sperm injection outcomes

[1,2]E. Borges Jr., [1,2]D. P. A. F. Braga, [2]B. F. Zanetti, [1,2]A. Iaconelli Jr. and [1,2]A. S. Setti

[1]Fertility Medical Group, Sao Paulo, Brazil, and [2]Sapientiae Institute, Sao Paulo, Brazil

Correspondence:
Edson Borges Jr., Fertility Medical Group, Av. Brigadeiro Luis Antonio, 4545, Sao Paulo, Brazil.
E-mail: science@sapientiae.org.br

Keywords:
Ejaculatory abstinence, ICSI, semen quality, sperm DNA fragmentation

Received: 13-Jul-2018
Revised: 4-Oct-2018
Accepted: 7-Nov-2018

doi: 10.1111/andr.12572

Linear model analysis of the association between sperm parameters and EA length (n = 818)

SEMEN PARAMETER	R	SLOPE	R^2 (%)	P-VALUE
Semen volume (mL)	0.1405	1.62102	5.28	<0.001
Sperm count ($x10^6$/mL)	3.1261	52.2206	2.59	<0.001
Total sperm count ($x10^6$)	18.941	170.650	8.37	<0.001
Total sperm motility (%)	-0.3355	19.0885	0.23	0.212
Progressive sperm motility (%)	-0.1895	19.1802	0.07	0.483
TMSC ($x10^6$)	9.6396	102.629	6.14	<0.001
Morphology (%)	0.0227	1.29926	0.23	0.215
SDF (%)	0.5355	9.34201	2.57	<0.001

FERTILITY

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Progressive sperm motility (%)	-0.1895	19.1802	0.07	0.483
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SDF (%)	0.5355	9.34201	2.57	<0.001

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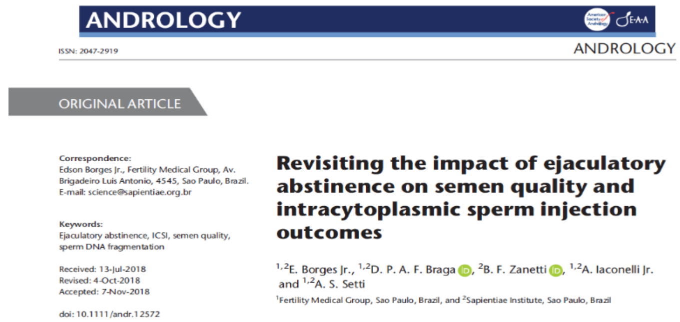

ANDROLOGY

ISSN: 2047-2919 ANDROLOGY

ORIGINAL ARTICLE

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Keywords:
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Revisiting the impact of ejaculatory abstinence on semen quality and intracytoplasmic sperm injection outcomes

[1,2]E. Borges Jr., [1,2]D. P. A. F. Braga, [2]B. F. Zanetti, [1,2]A. Iaconelli Jr. and [1,2]A. S. Setti

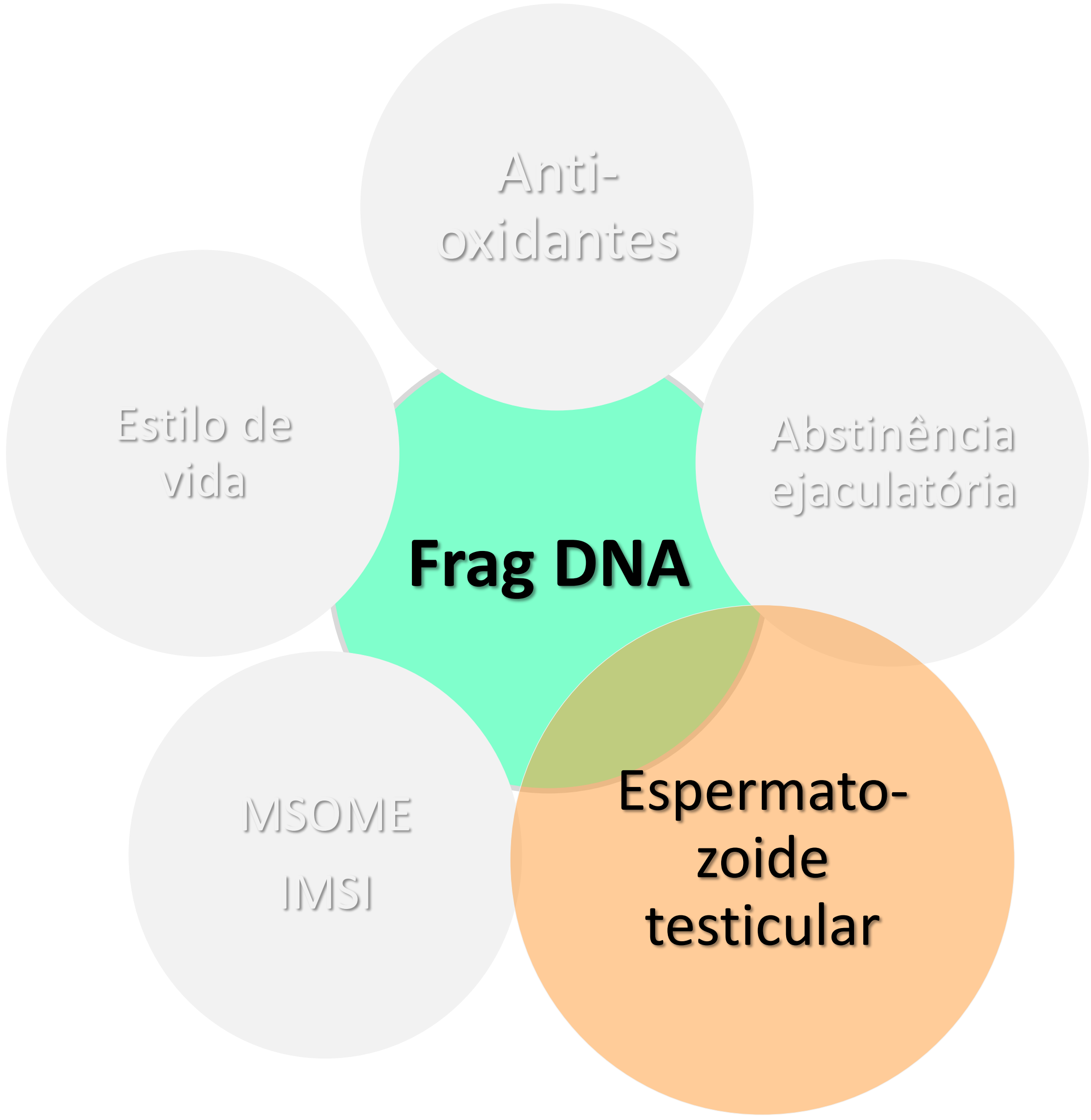
[1]Fertility Medical Group, Sao Paulo, Brazil, and [2]Sapientiae Institute, Sao Paulo, Brazil

Abstinência ejaculatória ≤ 4 dias:

- Frag DNA espermático significativamente menor, maiores taxas de fertilização, embriões de alta qualidade no dia 3, desenvolvimento a blastocisto, implantação e gestação quandocomparados ao grupo de abstinência ejaculatória > 4 dias.

- Taxas de implantação significativamente maiores e taxas de gestação tendendo a serem maiores com ***um dia de abstinência ejaculatória***, comparado a 2 – 4 de abstinência ejaculatória.

FERTILITY

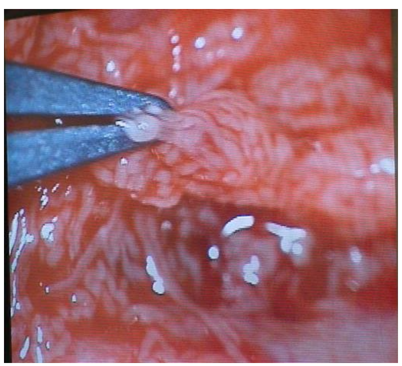

Anti-
oxidantes
Estilo de
vida
Abstinência
ejaculatória
Frag DNA
MSOME
IMSI
Espermato-
zoide
testicular

FERTILITY

Use of testicular sperm in nonazoospermic males

Akanksha Mehta, M.D.,[a] Sandro C. Esteves, M.D.,[b,c,d] Peter N. Schlegel, M.D.,[e] Craig I. Niederberger, M.D.,[f] Mark Sigman, M.D.,[g] Armand Zini, M.D.,[h] and Robert E. Brannigan, M.D.[i]

VOL. 109 NO. 6 / JUNE 2018



PRO: Emerging body of evidence supports use of testicular sperm for nonazoospermic males in several clinical settings

Pro 1. Akanksha Mehta, M.D., Fertile Battle Team Leader

Pro 2. Peter N. Schlegel, M.D.

Elevated Levels of Ejaculated Sperm DNA Damage: The Case for Use of Testicular Sperm

Pro 3. Sandro C. Esteves, M.D.

Recurrent IVF Failure and Recurrent Pregnancy Loss: The Case for Use of Testicular Sperm

CON: First do no harm—more data is needed before adapting use of testicular sperm in nonazoospermic male

Con 1. Craig I. Niederberger, M.D., Fertile Battle Team Leader

Con 2. Mark Sigman, M.D.

Elevated Levels of Ejaculated Sperm DNA Damage: The Case Against Use of Testicular Sperm

Con 3. Armand Zini, M.D.

Recurrent IVF Failure and Recurrent Pregnancy Loss: The Case Against Use of Testicular Sperm

FERTILITY

573 RBMO VOLUME 37 ISSUE 5 2018

RBMO

ELSEVIER

REVIEW

Testicular versus ejaculated spermatozoa for ICSI in patients without azoospermia: A systematic review

BIOGRAPHY
Hatem Awaga is Assistant Lecturer in Obstetrics and Gynecology at Sohag Faculty of Medicine, Egypt and PhD and fellowship student in the Unit of Human Reproduction, Aristotle University of Thessaloniki, Greece. He received his medical degree in 2007 and his MSc in 2012 from the Sohag Faculty of Medicine.

Hatem A Awaga[1,2], Julia K Bosdou[2], Dimitrios G Goulis[2], Katerina Chatzimeletiou[2], Mohamed Salem[1], Salah Roshdy[1], Grigoris Grimbizis[2], Basil C Tarlatzis[2], Efstratios M Kolibianakis[2,*]

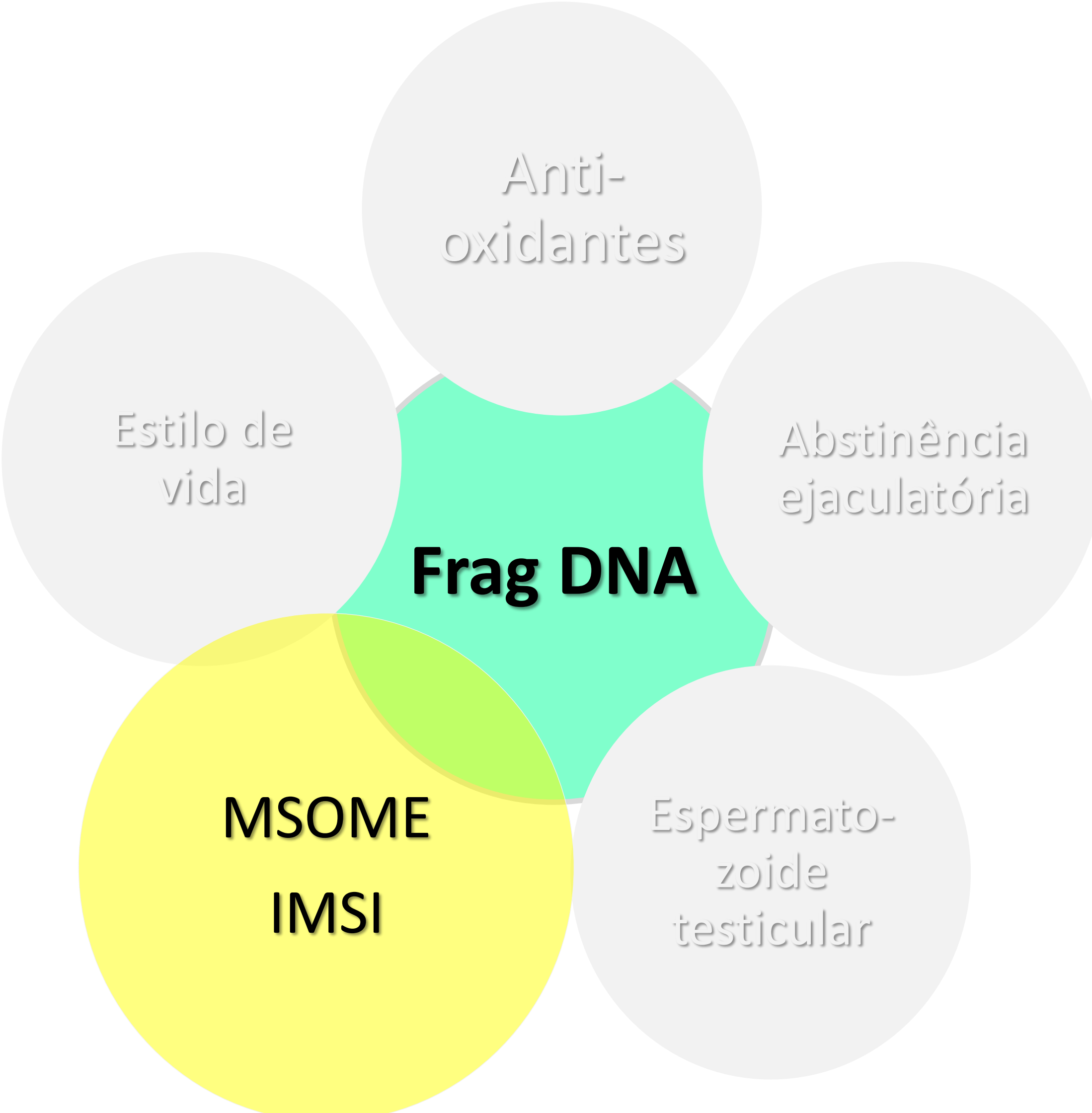
TABLE 3 CLINICAL PREGNANCY AND LIVE BIRTH IN THE TESTICULAR AND EJACULATED SPERMATOZOA GROUPS.

	High DFI only *Pabuccu et al. (2016)*	High DFI and oligozoospermia *Esteves et al. (2015)*	Isolated asthenozoospermia *Al-Malki et al. (2017)*	Asthenozoospermia with or without teratozoospermia *Kahraman et al. (1996)*
Clinical pregnancy	NR	NR	RR: 1.09, 95% CI: 0.56 to 2.14	RR: 2.85, 95% CI: 0.76 to 10.69
Live birth	RR: 2.36, 95% CI: 0.98 to 5.68	RR: 1.75, 95% CI: 1.14 to 2.70	NR	NR

CI = confidence interval; DFI = DNA fragmentation index; NR = not reported; RR = relative risk.

Há evidências limitadas e de baixa qualidade que sugerem que uma maior probabilidade de gravidez pode ser esperada usando espermatozoides testiculares e não ejaculados, apenas em homens com alto DFI e oligozoospermia.

FERTILITY


Anti-
oxidantes
Estilo de
vida
Abstinência
ejaculatória
Frag DNA
MSOME
IMSI
Espermato-
zoide
testicular

FERTILITY

MSOME Motile Sperm Organellar Morphology Examination

IMSI Intracytoplasmic Morphologically Select Sperm Injection

FERTILITY

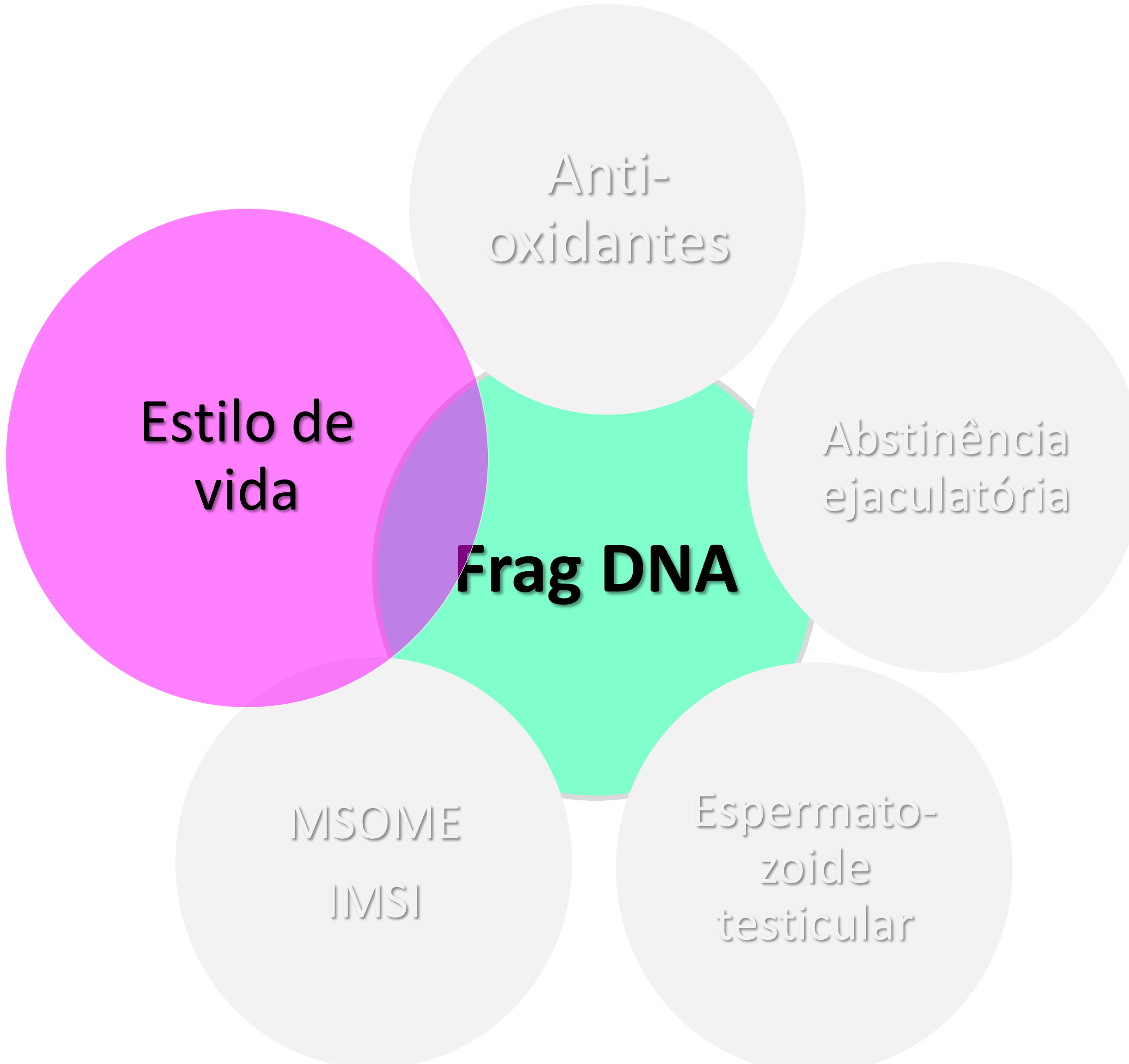
Infertility UROLOGY 78 (4), 2011

Sperm Organelle Morphologic Abnormalities: Contributing Factors and Effects on Intracytoplasmic Sperm Injection Cycles Outcomes

Daniela Paes de Almeida Ferreira Braga, Amanda S. Setti, Rita C. S. Figueira, Marcilio Nichi, Ciro D. Martinhago, Assumpto Iaconelli, Jr., and Edson Borges, Jr.

Table 1. Multivariate regression analysis of factors contributing to motile sperm organelle morphology defects incidence with variables including sperm DNA fragmentation percentage, patient's age, and sperm aneuploidy frequency

Predictor Variables	Response Variable MSOME	Slope	R^2	P
Percentage of sperm DNA fragmentation	Normal cells	−0.016	0.030	.145
	Abnormal shape	0.010	0.009	.411
	Abnormal size	0.004	0.189	<.001
	Large vacuoles	0.004	0.067	.029
	Small vacuoles	0.006	0.063	.034
Patient's age	Normal cells	−0.012	0.002	.715
	Abnormal shape	−0.001	0.030	.148
	Abnormal size	0.053	0.156	.135
	Large vacuoles	0.065	0.118	<.001
	Small vacuoles	0.198	0.104	<.001
Sperm aneuploidy	Normal cells	0.00291	0.009	.805
	Abnormal shape	0.00115	0.001	.960
	Abnormal size	0.08637	0.006	.528
	Large vacuoles	0.00291	0.009	.805
	Small vacuoles	0.00115	0.001	.960


Anti-
oxidantes
Estilo de
vida
Abstinência
ejaculatória
Frag DNA
MSOME
IMSI
Espermato-
zoide
testicular

FERTILITY

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ORIGINAL ARTICLE

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Paternal lifestyle factors in relation to semen quality and in vitro reproductive outcomes

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- Fator masculino isolado
- 1º. ciclo de tratamento
- Idade mulher < 36 anos
- 233 ciclos ICSI

1. Quantos cigarros/dia?
2. Consumo semanal de álcool?
3. Frequência de exercícios ?
4. Medicações nos últimos 3 meses? Qual?
5. Exposição a agentes tóxicos, pesticidas, radiação etc..

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Linear regression analyses' results for the influence of paternal lifestyle factors on semen quality (n=965)

	Cigarette smoking		Alcohol consumption	
	B	p	B	p
Semen volume	-0.417	0.047	-0.1363	0.592
Sperm count/mL	-7.363	0.014	-12.527	0.040
Total sperm count	-4.43	0.023	-34.91	0.156
Total sperm motility	2.316	0.347	0.342	0.895
Progressive sperm motility	-0.369	0.887	2.547	0.240
TMSC	- 1.38	0.045	-16.33	0.278
Sperm morphology	-0.0563	0.779	0.3751	0.180
SDF	0.014	0.033	5.833	0.002

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3. Lifestyle:

- smoking
- alcohol
- obesity
- stress
- advanced paternal age
- poor diet

4. Environmental

- heat
- pollution
- heavy metals
- plasticizers
- icide/ herbicides

5. Infection

- genito-urinary tract
- systemic infection

6. Autoimmune

- vasectomy
- torsion
- chronic prostatitis

7. Testicular

8. Chronic Disease

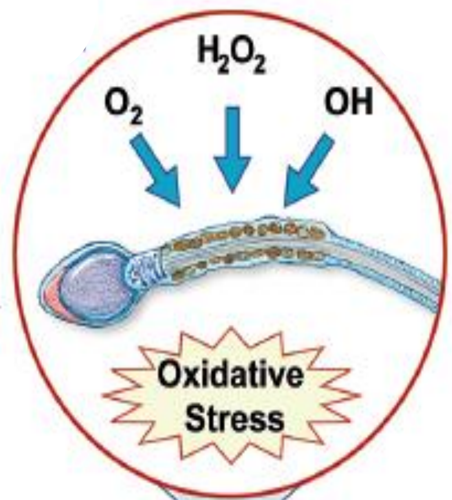
- diabetes
- CRF
- haemaglobinopathies
- hyperhomocysteinaemia

2. Iatrogenic

- centrifugation
- medications

1.Idiopathic

Anti-Oxidant



Damage to **sperm DNA** results
In infertility and miscarriage

Damage to **sperm membrane**
Decreases motility and the sperm's
ability to fuse with oocyte

Kelton Tremellen; Human Reproduction Update, Vol.14, No.3 pp. 243–258, 2008

FERTILITY

ARTICLE IN PRESS

ORIGINAL ARTICLE: ANDROLOGY

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Sperm DNA fragmentation is correlated with poor embryo development, lower implantation rate, and higher miscarriage rate in reproductive cycles of non–male factor infertility

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- 475 ciclos de ICSI / ausência de fator masculino
- fragDNA espermático ≥ 30% x < 30%
- Estudo coorte prospectivo

FERTILITY

Sperm DNA fragmentation is correlated with poor embryo development, lower implantation rate, and higher miscarriage rate in reproductive cycles of non–male factor infertility

Descriptive analysis of seminal parameters according to SDF groups.

Parameter	< 30% SDF (n = 433)	≥30% SDF (n = 42)	*P* value
Paternal age, y	38.68 ± 5.65	41.19 ± 6.35	.009
Ejaculatory abstinence, d	3.92 ± 2.42	5.51 ± 5.46	.002
Seminal volume, mL	2.94 ± 0.50	3.79 ± 1.09	.001
Seminal concentration, $\times 10^6$/mL	77.70 ± 29.83	81.09 ± 33.23	.677
Total sperm count, $\times 10^6$	214.58 ± 72.95	303.71 ± 78.80	.003
Total sperm motility, %	63.45 ± 12.75	55.52 ± 17.55	< .001
Progressive sperm motility, %	54.90 ± 14.27	46.50 ± 16.77	< .001
Total motile sperm count	121.11 ± 98.24	146.89 ± 139.09	.120
SDF, %	17.48 ± 8.70	37.67 ± 6.39	< .001

Borges. Sperm DNA fragmentation and ICSI outcomes. Fertil Steril 2019.