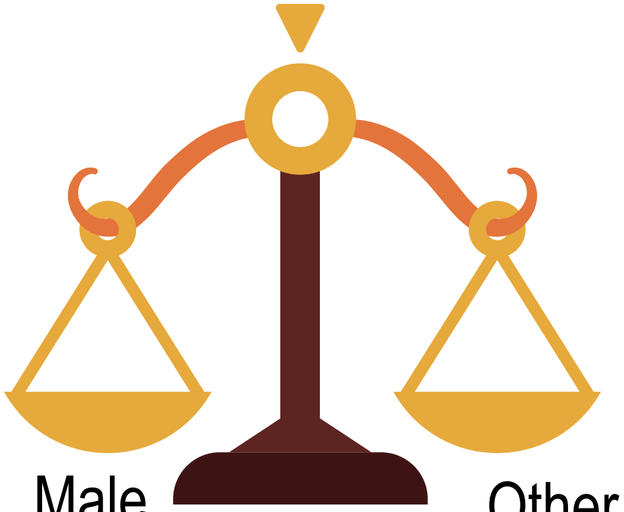
THE IMPACT OF SPERM DNA FRAGMENTATION ON ICSI OUTCOMES DEPENDS ON OOCYTE QUALITY

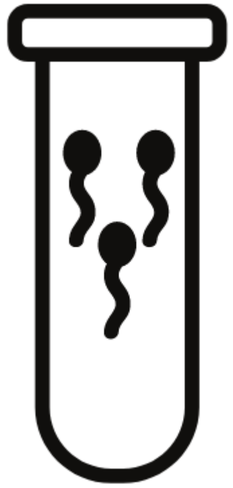
Daniela Paes de Almeida Ferreira Braga, Amanda Setti, Patrícia Guilherme, Rodrigo Rosa Provenza, Assumpto Iaconelli Jr., Edson Borges Jr.

INTRODUCTION



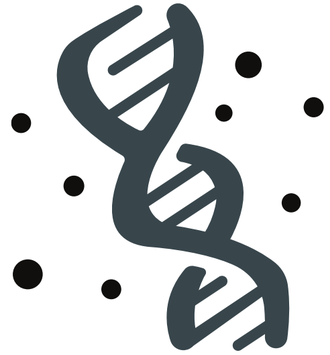
Male factor

Other

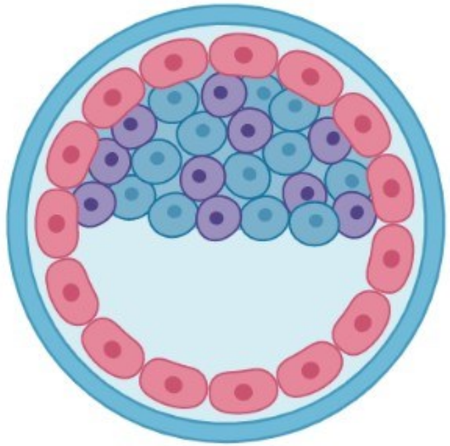


Parenthood may be achieved by assisted repro

Risk of transmission or induction of genetic and epigenetic conditions cannot be ignored



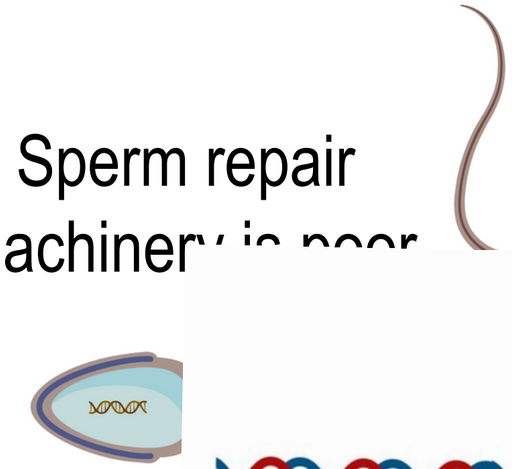
Unknown pathogenesis

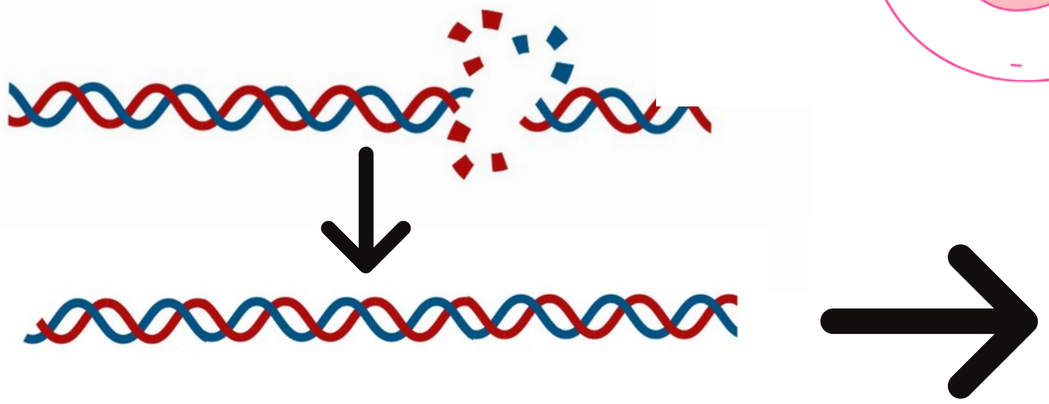


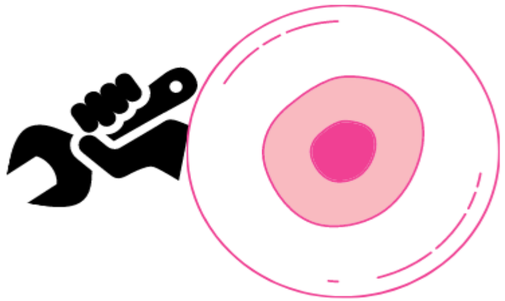
Sperm DNA damage, which is not amended by ICSI, compromises the embryo development

INTRODUCTION

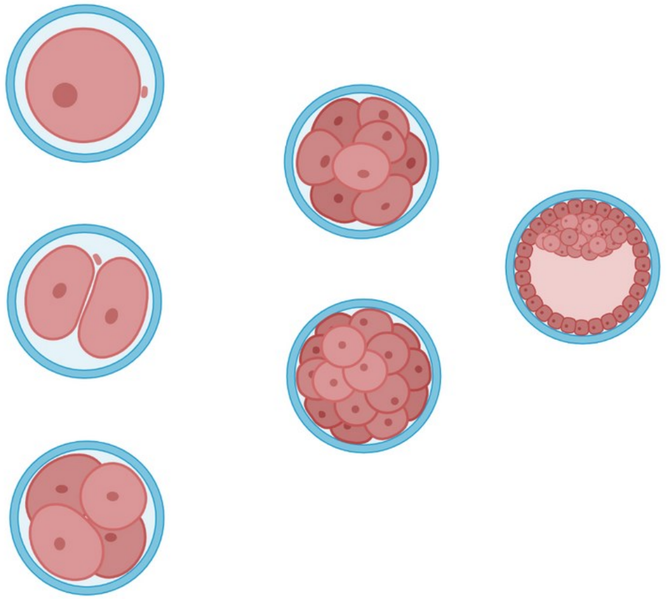
Sperm repair machinery is poor





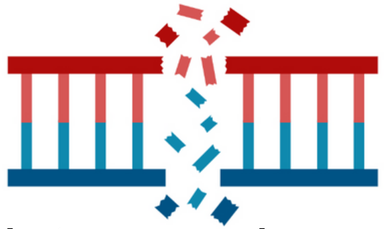


The oocyte is responsible for

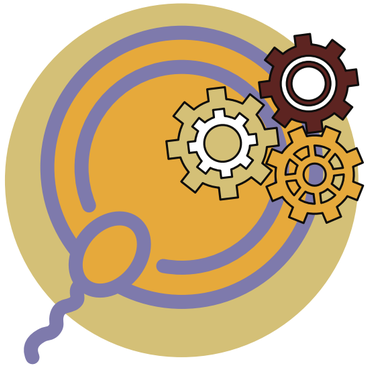


Espermatozoides com dano de DNA podem fertilizar óvulos e levar ao desenvolvimento embrionário graças à abilidade dos óvulos de reparar os danos no DNA

INTRODUCTION

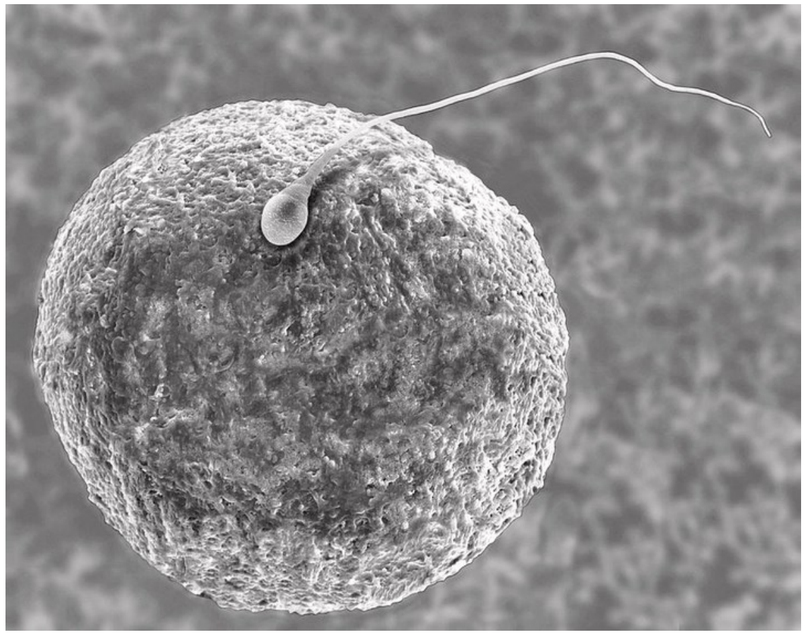


Nature or degree of DNA damage



Defects in the oocyte repair machinery

Oocyte quality can condition the negative impacts of SDF on pregnancy



Photograph by Dennis Kunkel Microscopy/scienc

INTRODUCTION

ARTICLE IN PRESS

ORIGINAL ARTICLE: ASSISTED REPRODUCTION

Oocyte ability to repair sperm DNA fragmentation: the impact of maternal age on intracytoplasmic sperm injection outcomes

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Older oocytes, when injected with sperm derived from samples with high SDF index, develop into embryos of poor quality

INTRODUCTION

Considering the vital role played by the oocyte in the developmental process

Hypothesis

Oocyte quality, as indicated by oocyte morphology, may influence the machinery responsible for DNA repair.

OBJECTIVE

The goal of the present study was to investigate whether the impact of SDF on ICSI outcomes depends on the presence of oocyte dimorphisms

MATERIAL AND METHODS

525 ICSI cycles

2,942 zygotes

<30% SDF n=1,468

≥30% SDF n=486

Presence of oocyte dimorphisms

ICSI outcomes

Generalized linear models Followed by Bonferroni

MATERIAL AND METHODS

Pituitary blockage with GnRH antagonist and COS with FSH

Incubation, denudation and nuclear maturation evaluation

Oocytes evaluated for morphology and ICSI performed according with Palermo et al (1992)

Embryo culture until day 5 (one or two blastocysts transferred)

MATERIAL AND METHODS

Intracytoplasmic oocyte dimorphisms

- Centrally located cytoplasmic granulation
- Vacuoles in the ooplasm
- Dark cytoplasm
- Smooth endoplasmic reticulum clusters

MATERIAL AND METHODS

Extracytoplasmic oocyte dimorphisms

- Large PVS
- Zona pellucida abnormalities
- PVS granularity
- Fragmented polar body

MATERIAL AND METHODS

Other oocyte dimorphisms

Shape abnormalities

Resistant membranes

Non-resistant membranes

MATERIAL AND METHODS

Sperm preparation: 2-layered density gradient centrifugation technique

SDF was measured by using a sperm chromatin dispersion (SCD) test

FERTILITY MEDICAL GROUP

RESULTS

A significant increase in the fertilization rate and high-quality embryo rate was noted for cycles with <30% SDF, when compared with cycles with ≥30% SDF, regardless of the presence of intracytoplasmic oocyte dimorphisms

	Oocyte Dimorphisms				
	CLCG + (n=313)		CLCG – (n=2,629)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	90.7 ± 0.4[a]	84.4 ± 0.8[b]	92.3 ± 1.2[a]	85.9 ± 1.49[b]	0.026
High-quality D3-embryos (%)	41.0 ± 1.1 [a]	34.0 ± 2.0[b]	44.0 ± 2.9[a]	37.0 ± 3.5[b]	0.035
	DC + (n=44)		DC – (n=2,898)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	74.6 ± 3.2 [a]	68.1 ± 3.3[b]	91.2 ± 0.4[c]	84.7 ± 0.8[d]	0.01
High-quality D3-embryos (%)	30.0 ± 7.2 [a]	24.0 ± 6.4[b]	42.0 ± 1.1[a]	35.0 ± 2.0[b]	0.02
	SERc + (n=110)		SERc – (n=2,832)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	90.7 ± 0.4[a]	84.2 ± 2.1[b]	96.8 ± 2.0[a]	84.1 ± 82.4[b]	<0.01
High-quality D3-embryos (%)	36.0 ± 4.8[a]	30.0 ± 4.6[b]	42.0 ±1.1[c]	35.0 ± 4.6[a]	0.013
	Vacuoles in ooplasm + (n=136)		Vacuoles in ooplasm - (n=2,881)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	89.5 ± 1.8[a]	82.9 ±1.9[b]	90.8 ± 0.44[c]	84.1 ± 0.83[d]	<0.01
High-quality D3-embryos (%)	39.0 ± 4.4 [a]	32.0 ± 4.3[b]	41.0 ± 1.1[c]	35.0 ± 1.9 [d]	0.014

RESULTS

The association of oocyte dimorphisms and a high SDF index resulted in the lowest fertilization rate

	Oocyte Dimorphisms				
	CLCG + (n=313)		CLCG – (n=2,629)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	90.7 ± 0.4[a]	84.4 ± 0.8[b]	92.3 ± 1.2[a]	85.9 ± 1.49[b]	0.026
High-quality D3-embryos (%)	41.0 ± 1.1 [a]	34.0 ± 2.0[b]	44.0 ± 2.9[a]	37.0 ± 3.5[b]	0.035
	DC + (n=44)		DC – (n=2,898)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	74.6 ± 3.2 [a]	68.1 ± 3.3[b]	91.2 ± 0.4[c]	84.7 ± 0.8[d]	0.01
High-quality D3-embryos (%)	30.0 ± 7.2 [a]	24.0 ± 6.4[b]	42.0 ± 1.1[a]	35.0 ± 2.0[b]	0.02
	SERc + (n=110)		SERc – (n=2,832)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	90.7 ± 0.4[a]	84.2 ± 2.1[b]	96.8 ± 2.0[a]	84.1 ± 82.4[b]	<0.01
High-quality D3-embryos (%)	36.0 ± 4.8[a]	30.0 ± 4.6[b]	42.0 ±1.1[c]	35.0 ± 4.6[a]	0.013
	Vacuoles in ooplasm + (n=136)		Vacuoles in ooplasm - (n=2,881)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	89.5 ± 1.8[a]	82.9 ±1.9[b]	90.8 ± 0.44[c]	84.1 ± 0.83[d]	<0.01
High-quality D3-embryos (%)	39.0 ± 4.4 [a]	32.0 ± 4.3[b]	41.0 ± 1.1[c]	35.0 ± 1.9 [d]	0.014

RESULTS

Significantly higher fertilization and high-quality embryo rates were observed for cycles with <30% SDF than for cycles with ≥30% SDF, regardless of the presence of extra-cytoplasmic dimorphisms

	Oocyte Dimorphisms				
	Large PVS + (n=626)		Large PVS – (n=2,391)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	90.0 ± 4.7[a]	85.4 ± 10.0[b]	92.1 ± 8.8[a]	83.6 ±8.5 [b]	<0.01
High-quality D3-embryos (%)	41.0 ±1.1[a]	36.0 ± 2.5 [b]	43.0 ± 2.1[a]	34.0 ±2.0[b]	0.011
	Fragmented PB + (n=924)		Fragmented PB – (n=2,093)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	89.1 ± 7.2[a]	84.8 ± 8.6[b]	90,5 ± 5.0[a]	82.4 ±1.0 [b]	<0.01
High-quality D3-embryos (%)	42.0 ± 1.7[a]	36.0 ± 2.3[b]	41.0 ±1.2[a]	34.0 ± 2.0 [b]	0.013
	NRM + (n=84)		NRM – (n=2,793)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	82.8 ± 2.2 [a]	76.0 ± 2.3[b]	91.0 ± 0.4[c]	84.2 ± 0.82[a]	<0.01
High-quality D3-embryos (%)	27.0 ± 4.4 [a]	22.0 ± 4.4[b]	42.0 ±1,1[c]	35.0 ±1.9[d]	0.011

RESULTS

Significantly higher fertilization and high-quality embryo rates were observed for cycles with <30% SDF than for cycles with ≥30% SDF, regardless of the presence of extracytoplasmic dimorphisms

	Oocyte Dimorphisms				
	RM + (n=98)		RM – (n=2,919)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	88.2 ± 2.1[a]	81.6 ±2.2[b]	90.8 ± 0.44[a]	84.2 ± 0.8 [b]	<0.01
High-quality D3-embryos (%)	35.0 ± 5.0 [a]	29.0 ± 5.2[b]	41.0 ± 1.0[c]	35.0 ±2.0[a]	0.018
	Shape abnormalities + (n=86)		Shape abnormalities - (n=2,931)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	87.7 ± 2.3 [a]	81.1 ±2.4[b]	90.8 ± 0.44[c]	84.1 ±0.82[a]	<0.01
High-quality D3-embryos (%)	37.0 ± 5.3[a]	31.0 ± 5.1[b]	41.0 ± 1.0[c]	35.0 ± 1.9[a]	0.013
	ZP abnormalities + (n=236)		ZP abnormalities - (n=2,781)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	88.4 ± 1.4[a]	81.8 ± 1.5[b]	90.9 ± 0.44[a]	84.3 ± 0.83[b]	<0.01
High-quality D3-embryos (%)	40.0 ± 3.4[a]	33.0 ± 3.4[b]	41.0 ± 1.1[a]	35.0 ± 1.9 [b]	0.015

RESULTS

The association of oocyte dimorphism and a high SDF index resulted in the lowest fertilization and/or high-quality embryo rates

	Oocyte Dimorphisms				
	NRM + (n=84)		**NRM – (n=2,793)**		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	82.8 ± 2.2 [a]	76.0 ± 2.3[b]	91.0 ± 0.4[c]	84.2 ± 0.82[a]	<0.01
High-quality D3-embryos (%)	27.0 ± 4.4 [a]	22.0 ± 4.4[b]	42.0 ±1,1[c]	35.0 ±1.9[d]	0.011
	Shape abnormalities + (n=86)		**Shape abnormalities - (n=2,931)**		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	87.7 ± 2.3 [a]	81.1 ±2.4[b]	90.8 ± 0.44[c]	84.1 ±0.82[a]	<0.01
High-quality D3-embryos (%)	37.0 ± 5.3[a]	31.0 ± 5.1[b]	41.0 ± 1.0[c]	35.0 ± 1.9[a]	0.013
	RM + (n=98)		**RM – (n=2,919)**		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Fertilization (%)	88.2 ± 2.1[a]	81.6 ±2.2[b]	90.8 ± 0.44[a]	84.2 ± 0.8 [b]	<0.01
High-quality D3-embryos (%)	35.0 ± 5.0 [a]	29.0 ± 5.2[b]	41.0 ± 1.0[c]	35.0 ±2.0[a]	0.018

RESULTS

A decrease in implantation and pregnancy rates were noted for cycles with ≥30% SDF, when compared with cycles with <30% SDF, regardless of the presence of intracytoplasmic dimorphisms

	Oocyte Dimorphisms				
	CLCG + (n=62)		CLCG – (n=561)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.9 ± 2.9[a]	8.2 ± 3.4[b]	20.1 ± 1.0[a]	7.9 ± 1.6[b]	<0.01
Pregnancy (%)	21.0 ± 3.2[a]	8.0. ± 1.9 [b]	20.0 ± 1.1[a]	7.0 ± 1.2 [b]	<0.01
	DC + (n=8)		DC – (n=615)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	19.7 ± 5.8[a]	6.9 ± 6.0[b]	20.2 ± 9.7[a]	7.4 ± 1.6[b]	0.01
Pregnancy (%)	19.7 ± 5.8[a]	7.4 ± 1.7[b]	20.2 ± 9.7[a]	6.9 ± 6.0[b]	<0.01
	SERc + (n=31)		SERc – (n=592)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	23.4 ± 3.8[a]	10.5 ± 4.0[b]	20.0 ± 9.8[a]	7.2 ± 1.7 [c]	<0.01
Pregnancy (%)	24.0 ± 4.8[a]	9.0 ± 2.5[b]	20.0 ± 1.1[a]	7.0 ± 12.0[b]	0.013
	Vacuoles in ooplasm + (n=29)		Vacuoles in ooplasm - (n=594)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.5 ± 9.8[a]	7.8 ± 1.7[b]	36.2 ± 4.3[c]	13.0 ± 4.1[d]	<0.01
Pregnancy (%)	11.1 ± 3.9 [a]	4.0 ± 1.6 [b]	21.0 ± 11.1[c]	8.0 ± 12.0[d]	<0.01

RESULTS The associations of both male and female factors also impacted the clinical results

	Oocyte Dimorphisms				
	CLCG + (n=62)		CLCG – (n=561)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.9 ± 2.9[a]	8.2 ± 3.4[b]	20.1 ± 1.0[a]	7.9 ± 1.6[b]	<0.01
Pregnancy (%)	21.0 ± 3.2[a]	8.0. ± 1.9 [b]	20.0 ± 1.1[a]	7.0 ± 1.2 [b]	<0.01
	DC + (n=8)		DC – (n=615)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	19.7 ± 5.8[a]	6.9 ± 6.0[b]	20.2 ± 9.7[a]	7.4 ± 1.6[b]	0.01
Pregnancy (%)	19.7 ± 5.8[a]	7.4 ± 1.7[b]	20.2 ± 9.7[a]	6.9 ± 6.0[b]	<0.01
	SERc + (n=31)		SERc – (n=592)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	23.4 ± 3.8[a]	10.5 ± 4.0[b]	20.0 ± 9.8[a]	7.2 ± 1.7 [c]	<0.01
Pregnancy (%)	24.0 ± 4.8[a]	9.0 ± 2.5[b]	20.0 ± 1.1[a]	7.0 ± 12.0[b]	0.013
	Vacuoles in ooplasm + (n=29)		Vacuoles in ooplasm - (n=594)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.5 ± 9.8[a]	7.8 ± 1.7[b]	36.2 ± 4.3[c]	13.0 ± 4.1[d]	<0.01
Pregnancy (%)	11.1 ± 3.9 [a]	4.0 ± 1.6 [b]	21.0 ± 11.1[c]	8.0 ± 12.0[d]	<0.01

RESULTS

The effect of SDF on miscarriage rates was significantly influenced by the presence of CLCG

	Oocyte Dimorphisms				
	CLCG + (n=62)		CLCG – (n=561)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	4.0 ± 3.1 [a]	31.0 ± 8.3 [b]	3.0 ± 8.8[a,c]	12.0 ± 1.9[c]	0.025
	DC + (n=8)		DC – (n=615)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	11.0 ± 1.9[a]	28.0 ± 7.5 [b]	0.0 ± 0.0 [c]	0.0 ±0.0[c]	<0.01
	SERc + (n=31)		SERc – (n=592)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	12.0 ± 24.0[a]	29 ± 19.0[b]	0.0 ± 0.0[c]	0.0 ± 0.0[c]	<0.01
	Vacuoles in ooplasm + (n=29)		Vacuoles in ooplasm - (n=594)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	11.0 ± 1.9 [a]	29.0 ±7.6 [b]	0.0 ± 0.0 [c]	0.0 ± 0.0 [c]	<0.01

RESULTS

Significant decrease in implantation and pregnancy rates for cycles with ≥30% SDF, when compared with cycles with <30% SDF, regardless of the presence of extracytoplasmic dimorphisms

	Oocyte Dimorphisms				
	Large PVS + (n=57)		Large PVS – (n=566)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	15.8 ± 22.4[a]	5.9 ± 12.1[b]	21.2 ± 13.2[c]	7.9 ± 13.5[d]	<0.01
Pregnancy (%)	16.0 ± 2.1[a]	6.0 ± 1.2[b]	21.0 ± 1.2[c]	8.0 ± 1.3[d]	0.015
	PVS granularity (n=207)		PVS granularity (n=416)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.7 ± 1.3[a]	17.9 ± 1.9[b]	19.7 ± 1.2[a]	6.9 ± 1.8[c]	<0.01
Pregnancy (%)	21.0 ± 1.5[a]	8.0 ± 1.3[b]	20.0 ± 1.4[a]	7.0 ± 1.2[c]	<0.01
	Fragmented PB + (n=199)		Fragmented PB – (n=424)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	17.2 ± 1.6[a]	4.3 ± 2.1[b]	21.4 ± 1.1[a]	8.5 ± 1.7[c]	<0.01
Pregnancy (%)	17.0 ± 1.7 [a]	6.0 ± 1.1[b]	22.0 ± 1.3[a]	8.0 ± 1.1[c]	0.013

RESULTS

Significant decrease in implantation and pregnancy rates for cycles with ≥30% SDF, when compared with cycles with <30% SDF, regardless of the presence of extracytoplasmic dimorphisms

	Oocyte Dimorphisms				
	NRM + (n=28)		NRM – (n=595)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	16.1 ± 5.3[a]	5.9 ± 4.8[b]	20.3 ± 9.8[a]	7.5 ± 1.6[b]	<0.01
Pregnancy (%)	16.1 ± 0.56[a]	5.9 ± 0.2[b]	20.3 ± 0.11[a]	7.4 ± 0.12[b]	<0.01
	RM + (n=24)		RM – (n=599)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	15.4 ± 4.3[a]	2.6 ± 4.5[b]	20.4 ± 9.8[a]	7.6 ± 1.7[b]	<0.01
Pregnancy (%)	15.0 ± 4.7[a]	6.0 ± 2.1[b]	20.0 ± 1.1[a]	8.0 ± 1.0[b]	0.018
	Shape abnormalities + (n=30)		Shape abnormalities - (n=593)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	28.0 ± 4.8[a]	16.2 ± 5.0[b]	19.9 ± 8.4[a]	7.2 ± 1.7[b]	<0.01
Pregnancy (%)	30.0 ± 6.2[a]	12.0 ± 3.6[b]	20.0 ± 1.1[a]	7.0 ± 1.2[b]	0.013
	ZP abnormalities + (n=62)		ZP abnormalities - (n=561)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	8.4 ± 0.24[a]	3.2 ± 0.1[b]	21.2 ± 0.12[a]	3.2 ± 0.10[b]	<0.01
Pregnancy (%)	9.0 ± 2.4[a]	3.0 ± 1.0[b]	21.0 ± 1.1[a]	8.0 ± 1.3[b]	0.015

RESULTS

The presence of large PVS, NRM, RM, shape abnormalities and ZP abnormalities resulted in decreased rates of implantation and pregnancy for both SDF index groups

	Oocyte Dimorphisms				
	Large PVS + (n=57)		Large PVS – (n=566)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	15.8 ± 22.4^{a}	5.9 ± 12.1^{b}	21.2 ± 13.2^{c}	7.9 ± 13.5^{d}	<0.01
Pregnancy (%)	16.0 ± 2.1^{a}	6.0 ± 1.2^{b}	21.0 ± 1.2^{c}	8.0 ± 1.3^{d}	0.015
	NRM + (n=28)		NRM – (n=595)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	16.1 ± 5.3^{a}	5.9 ± 4.8^{b}	20.3 ± 9.8^{a}	7.5 ± 1.6^{b}	<0.01
Pregnancy (%)	16.1 ± 0.56^{a}	5.9 ± 0.2^{b}	20.3 ± 0.11^{a}	7.4 ± 0.12^{b}	<0.01
	RM + (n=24)		RM – (n=599)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	15.4 ± 4.3^{a}	2.6 ± 4.5^{b}	20.4 ± 9.8^{a}	7.6 ± 1.7^{b}	<0.01
Pregnancy (%)	15.0 ± 4.7^{a}	6.0 ± 2.1^{b}	20.0 ± 1.1^{a}	8.0 ± 1.0^{b}	0.018

RESULTS

The presence of large PVS, NRM, RM, shape abnormalities and ZP abnormalities resulted in decreased rates of implantation and pregnancy for both SDF index groups

	Oocyte Dimorphisms				
	Shape abnormalities + (n=30)		Shape abnormalities - (n=593)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	28.0 ± 4.8[a]	16.2 ± 5.0[b]	19.9 ± 8.4[a]	7.2 ± 1.7[b]	<0.01
Pregnancy (%)	30.0 ± 6.2[a]	12.0 ± 3.6[b]	20.0 ± 1.1[a]	7.0 ± 1.2[b]	0.013
	ZP abnormalities + (n=62)		ZP abnormalities - (n=561)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	8.4 ± 0.24[a]	3.2 ± 0.1[b]	21.2 ± 0.12[a]	3.2 ± 0.10[b]	<0.01
Pregnancy (%)	9.0 ± 2.4[a]	3.0 ± 1.0[b]	21.0 ± 1.1[a]	8.0 ± 1.3[b]	0.015

RESULTS

The association of a higher SDF index with the presence of oocyte dimorphisms impacted the clinical results for oocytes presenting large PVS, PVS granularity and fragmented PB

	Oocyte Dimorphisms				
	Large PVS + (n=57)		Large PVS – (n=566)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	15.8 ± 22.4[a]	5.9 ± 12.1[b]	21.2 ± 13.2[c]	7.9 ± 13.5[d]	<0.01
Pregnancy (%)	16.0 ± 2.1[a]	6.0 ± 1.2[b]	21.0 ± 1.2[c]	8.0 ± 1.3[d]	0.015
	PVS granularity (n=207)		PVS granularity (n=416)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	20.7 ± 1.3[a]	17.9 ± 1.9[b]	19.7 ± 1.2[a]	6.9 ± 1.8[c]	<0.01
Pregnancy (%)	21.0 ± 1.5[a]	8.0 ± 1.3[b]	20.0 ± 1.4[a]	7.0 ± 1.2[c]	<0.01
	Fragmented PB + (n=199)		Fragmented PB – (n=424)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Implantation (%)	17.2 ± 1.6[a]	4.3 ± 2.1[b]	21.4 ± 1.1[a]	8.5 ± 1.7[c]	<0.01
Pregnancy (%)	17.0 ± 1.7 [a]	6.0 ± 1.1[b]	22.0 ± 1.3[a]	8.0 ± 1.1[c]	0.013

RESULTS

The effect of SDF on miscarriage rates was significantly influenced by the presence of large PVS and NRM

	Oocyte Dimorphisms				
	Large PVS + (n=57)		Large PVS – (n=566)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	6.0 ±3.1[a]	30.0 ±8.1[b]	17.0 ± 8.7[a,b]	12.0 ± 2.0[a,b]	0.581
	NRM + (n=28)		NRM – (n=595)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	5.8 ± 19.7[a]	30.0 ± 15.2[b]	11.0 ± 18.0[a,b]	22.0 ± 7.4[a,b]	0.378
	RM + (n=24)		RM – (n=599)		
Groups	<30% SDF	≥30% SDF	<30% SDF	≥30% SDF	p
Miscarriage (%)	4.6 ± 18.6[a]	8.0 ± 13.5[b]	4.6 ± 18.6[a]	3.0 ± 8.3[b]	0.378

CONCLUSION

The association of low oocyte quality and high SDF indexes may compromise the clinical outcomes specially the miscarriage rate.

WIDER IMPLICATIONS OF THE FINDINGS

The findings presented here are particularly important for informing patients about the crucial role of both male and female factors when facing ART cycles.

The negative impacts of a high degree of DNA fragmentation on clinical outcomes can be overcome by using high-quality oocytes.

Our evidence supports the hypothesis that defective oocytes lose their ability to cope with SDF and avoid pregnancy loss due to DNA damage in sperm.

As oocyte defects usually cannot be modified, the in vivo improvement of spermatozoa before ART should be stimulated.

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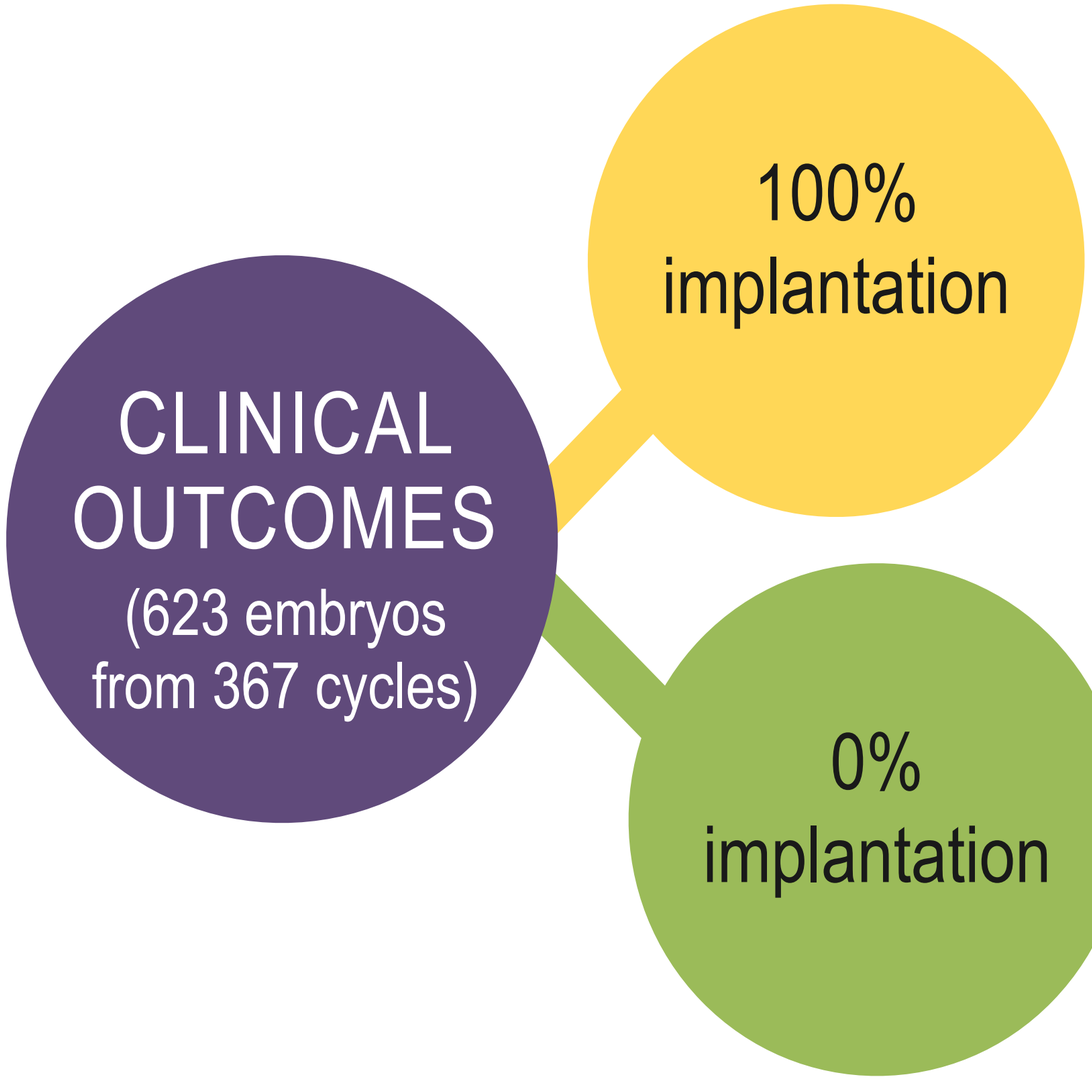
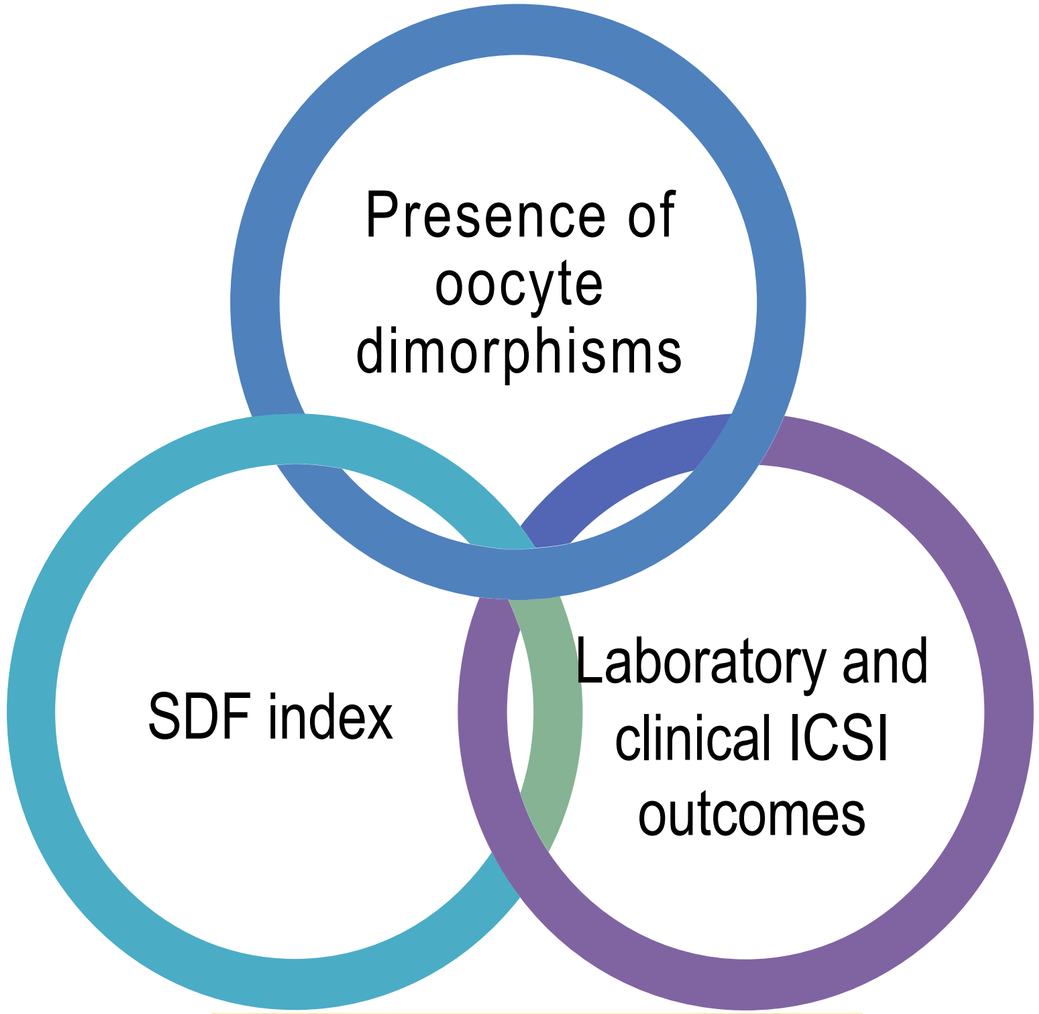
MATERIAL AND METHODS





Generalized linear models
Followed by Bonferroni