Σύνδρομο Πολυκυστικών ωοθηκών και εκτίμηση κινδύνου για εμφάνιση Σακχαρώδη Διαβήτη τύπου 2

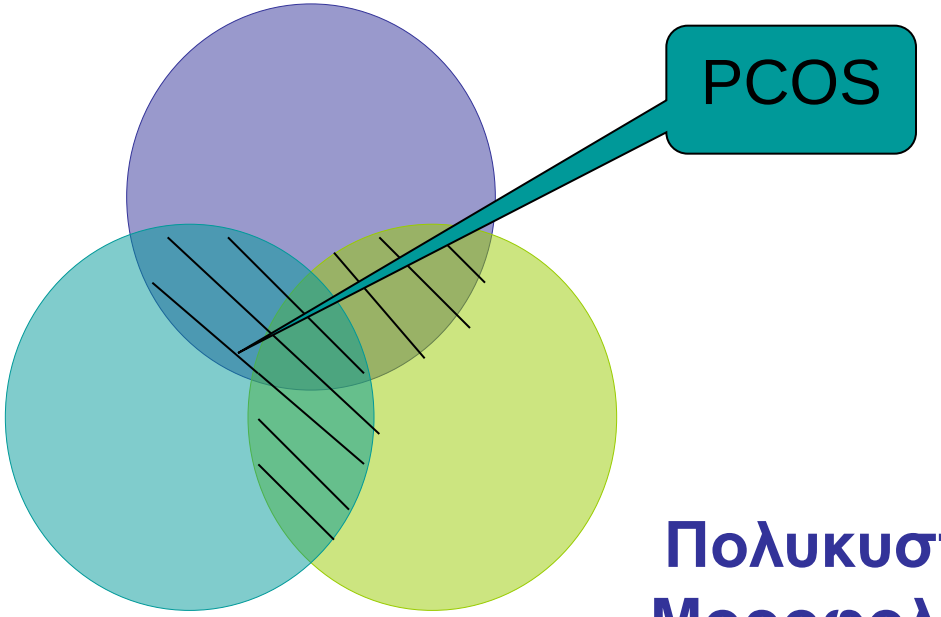
Σαράντης Λιβαδάς

Ενδοκρινολόγος
Ιατρικό Κέντρο Αθηνών

HEN
ΕΛΛΗΝΙΚΟ ΔΙΚΤΥΟ ΕΝΔΟΚΡΙΝΟΛΟΓΩΝ

Σύνδρομο - Όχι Νόσος!!!

Χρόνια Ανωοθυλακιορρηξία



Πολυκυστική Μορφολογία

Υπερανδρογοναιμία

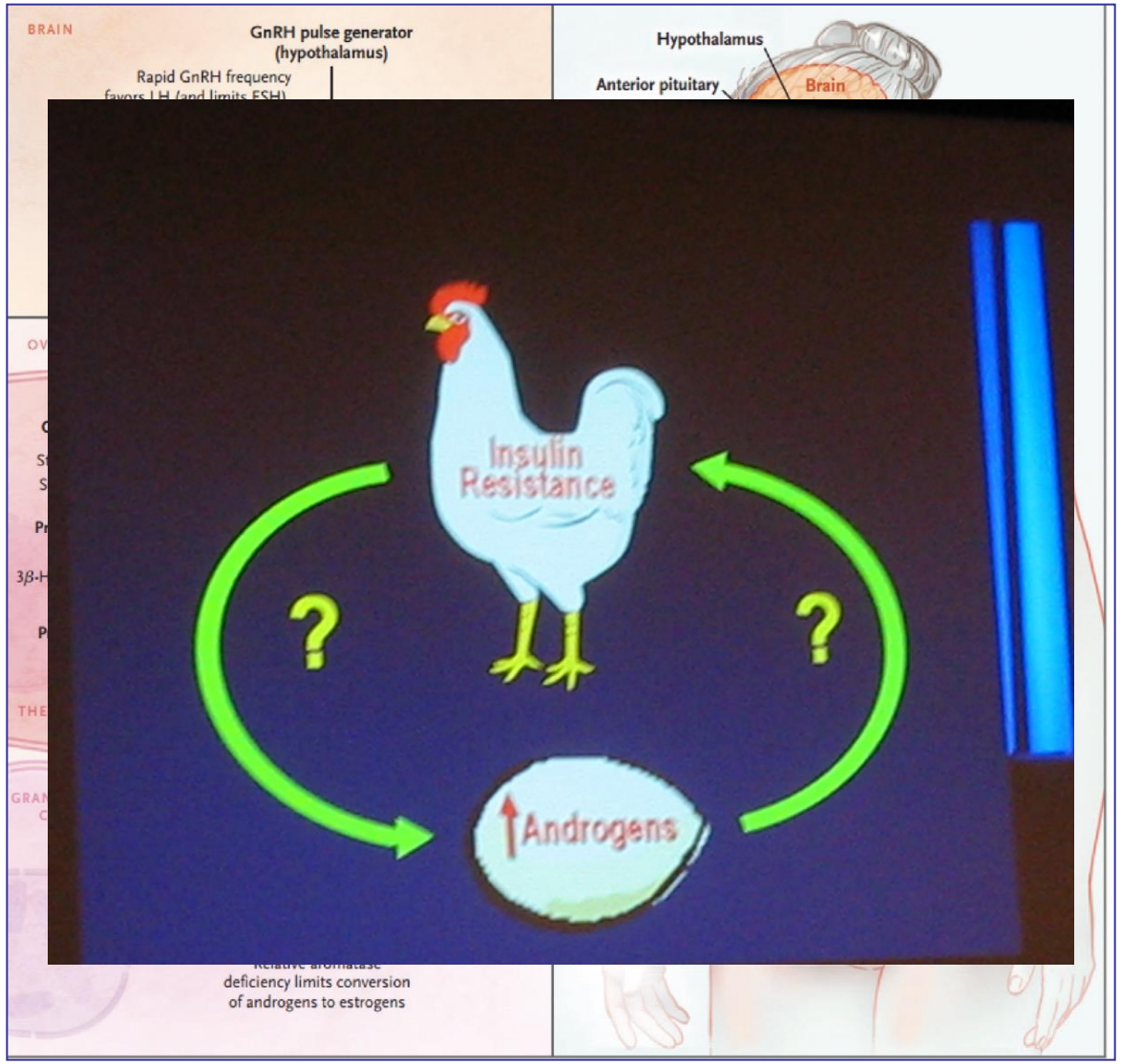
Κριτήρια

NIH 1990	Rotterdam 2003	AE-PCOS Society 2006
• Chronic anovulation • Clinical and/or biochemical signs of hyperandrogenism (with exclusion of other etiologies, e.g., congenital adrenal hyperplasia) *(Both criteria needed)*	• Oligo- and/or anovulation • Clinical and/or biochemical signs of hyperandrogenism • Polycystic ovaries *(Two of three criteria needed)*	• Clinical and/or biochemical signs of hyperandrogenism • Ovarian dysfunction (Oligo-anovulation and/or polycystic ovarian morphology) *(Both criteria needed)*

Επιπολασμός

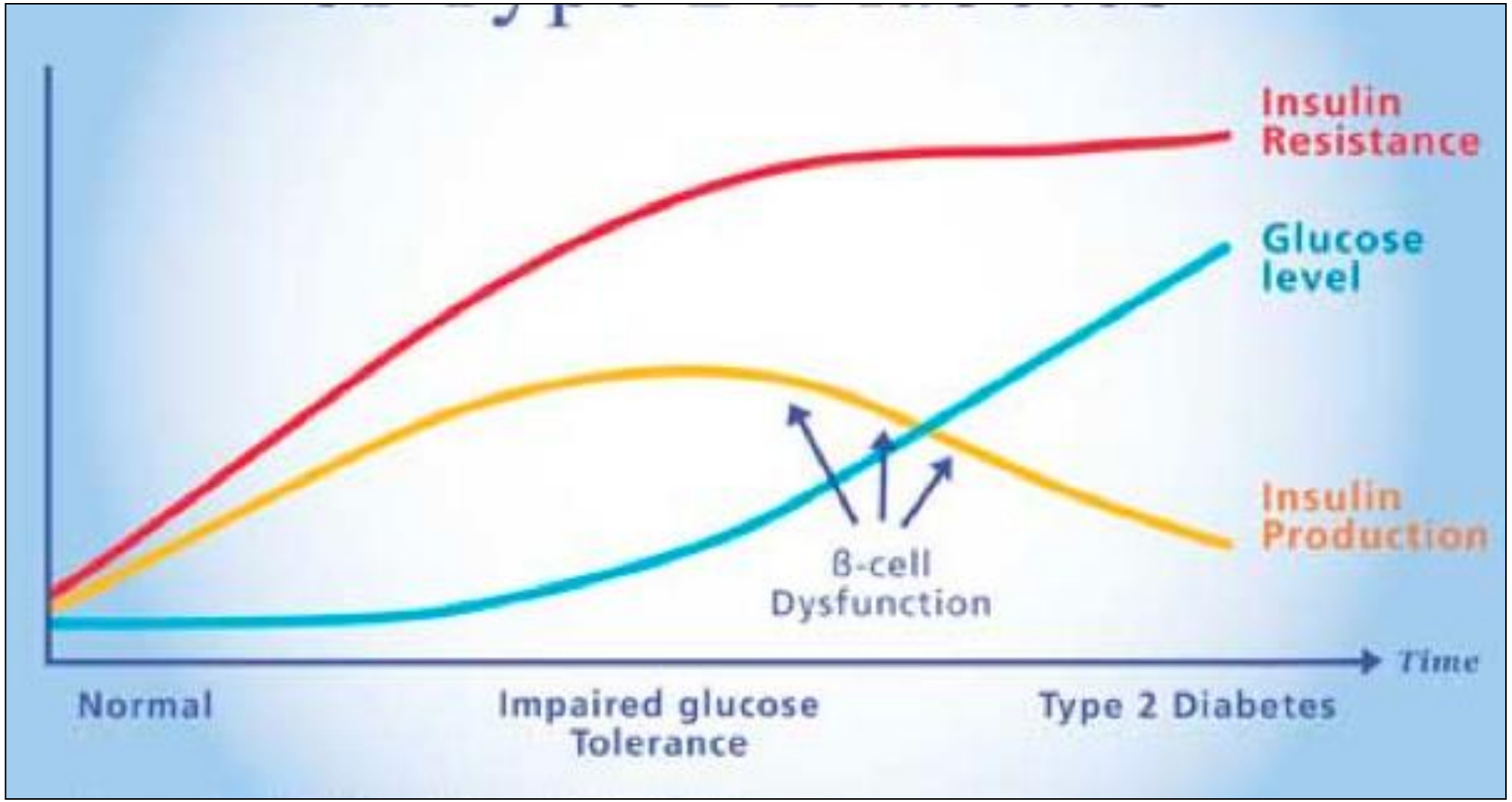
6-10%	**15-25%**	**10-15%**

PCOS pathophysiology



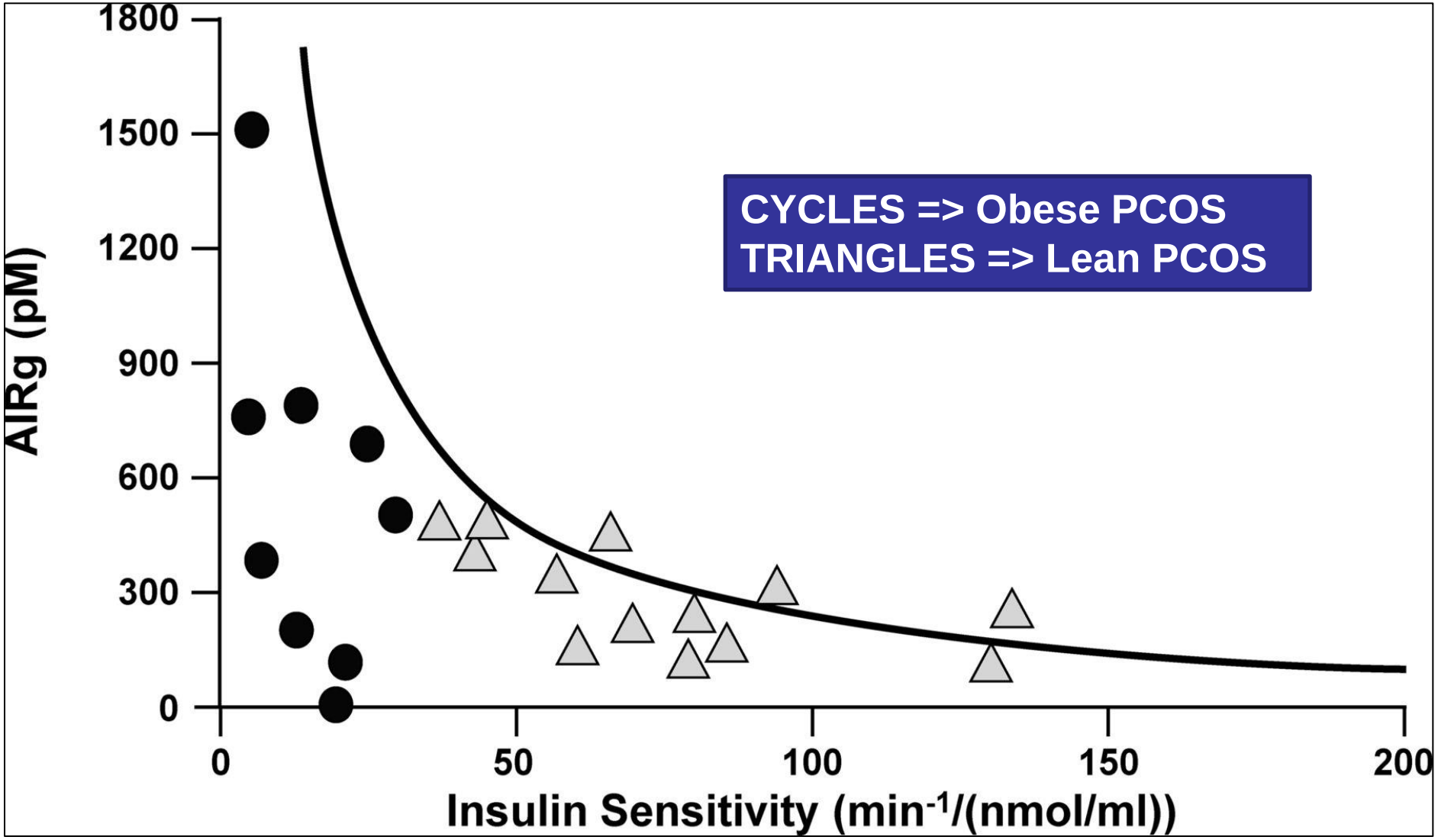
Cartney, et al., New England Journal of Medicine, 2016.

DM2 development - Natural history

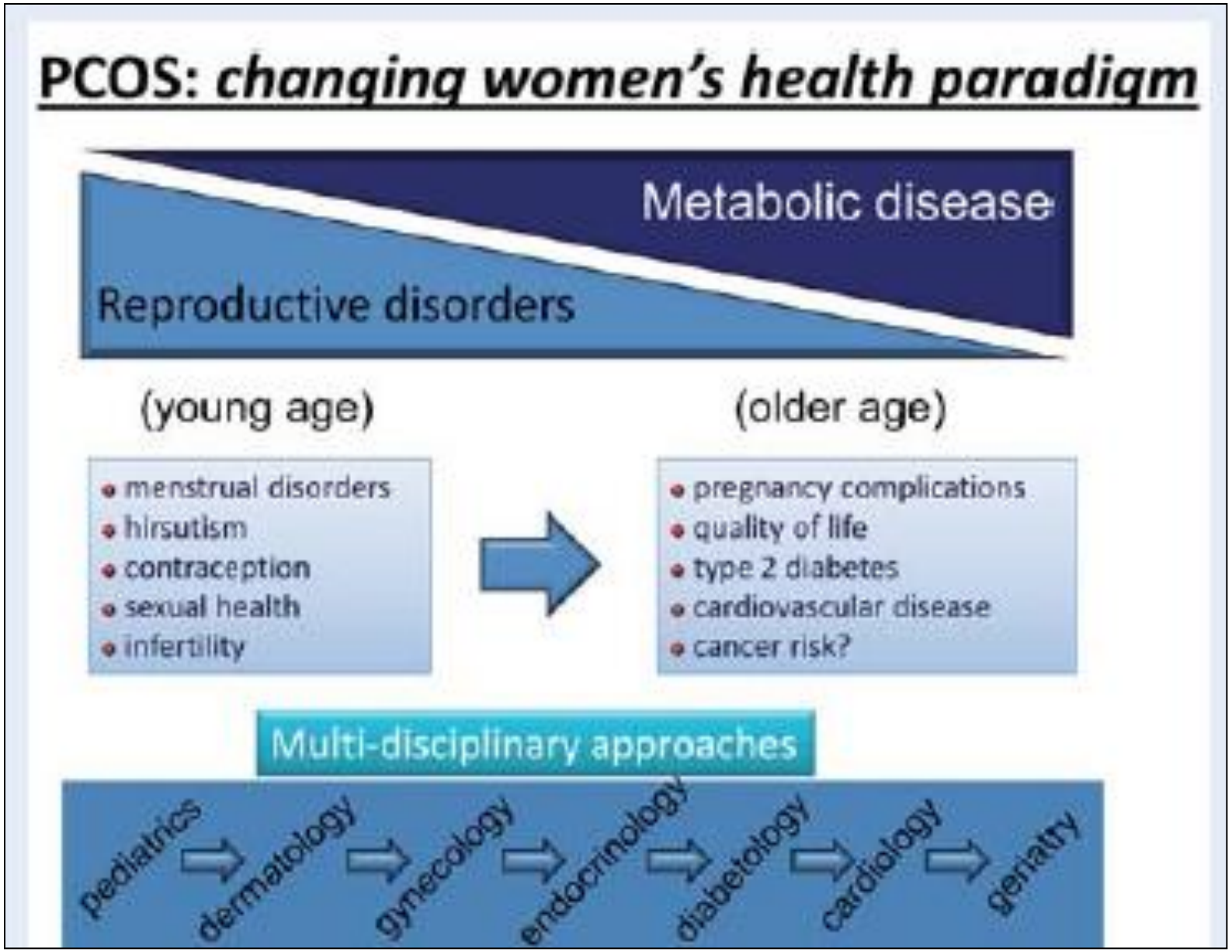


Henry, Am J Med 1998

β-cell dysfunction in women with PCOS



Diamanti-Kandarakis E and Dunaif A Endocrine Reviews 2012



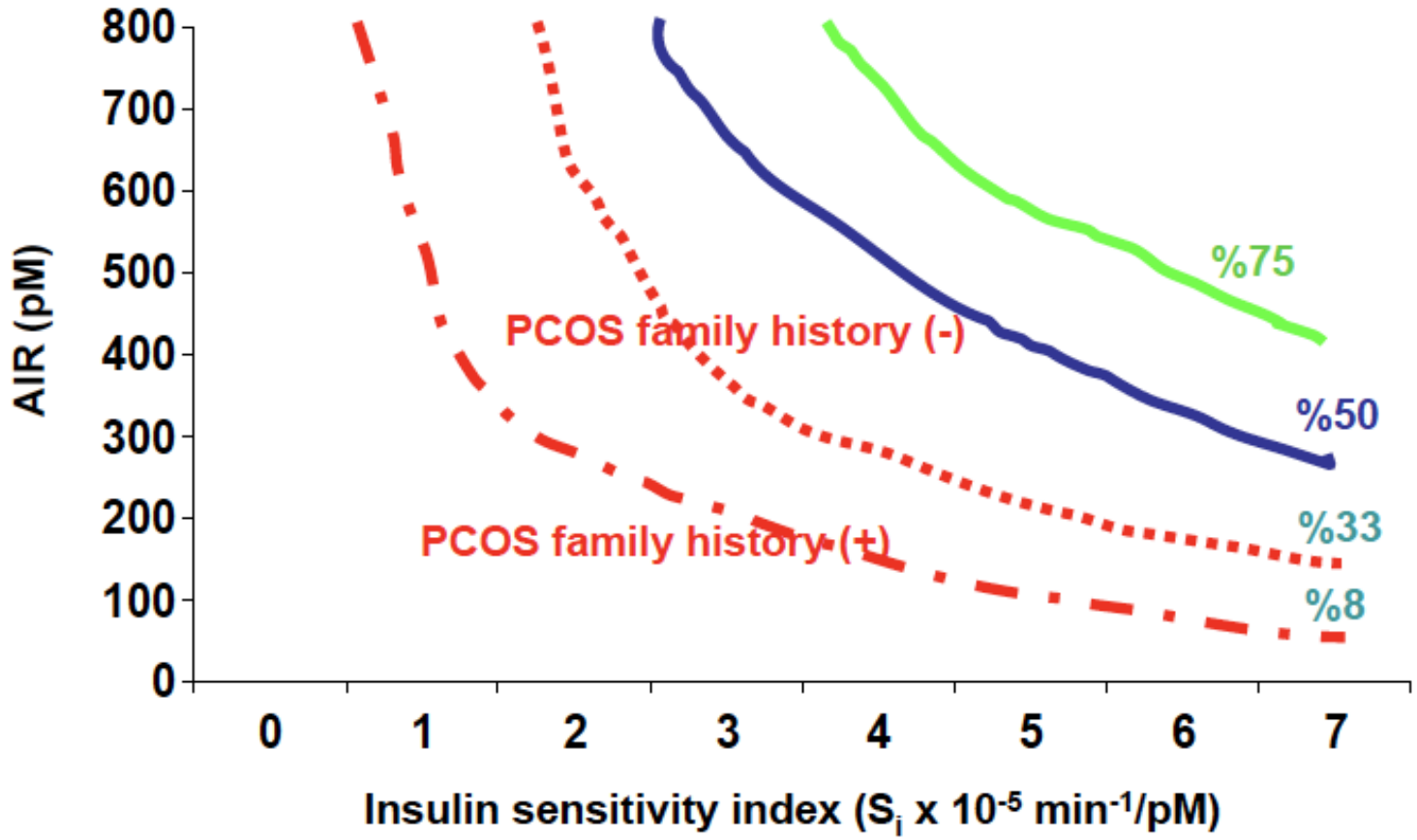
Human Reproduction, Vol.27, No.1 pp. 14–24, 2012

Associations Between Key Concerns About PCOS and Age

Key Concern	Age 18–25 y	Age 36–45 y	Age >45 y
No. of women		1375	
Reference category		26–35 y	
Difficulty losing weight	1.0 (0.7–1.4)	1.1 (0.9–1.4)	1.3 (0.8–2.0)
Irregular cycles	1.5[b] (1.1–2.0)	0.6[a] (0.5–0.8)	0.2[c] (0.1–0.3)
Infertility	0.8 (0.5–1.1)	0.6[c] (0.4–0.7)	0.3[c] (0.2–0.4)
Excess hair growth	0.9 (0.6–1.3)	1.4[a] (1.1–1.8)	1.5 (1.0–2.3)
Hormone imbalance/excess male-type hormones	0.7 (0.5–1.0)	1.0 (0.7–1.2)	0.7 (0.4–1.1)
Increased tendency for weight gain	1.0 (0.7–1.4)	1.3[b] (1.0–1.7)	1.5 (0.9–2.3)
Insulin resistance	0.6[b] (0.4–0.9)	1.4[b] (1.1–1.8)	1.7[b] (1.1–2.6)
Anxiety/depression	1.3 (0.9–1.8)	0.8 (0.6–1.1)	1.1 (0.7–1.8)
Increased metabolic risk	1.0 (0.6–1.7)	1.6[b] (1.1–2.2)	3.6[c] (2.2–5.8)
Acne	1.0 (0.6–1.6)	0.8 (0.5–1.2)	0.4[b] (0.1–1.0)
Cysts on ovaries	1.6[b] (1.0–2.5)	0.8 (0.5–1.2)	0.5 (0.2–1.2)
Pregnancy complications	0.8 (0.5–1.4)	0.4[c] (0.3–0.7)	0.3[a] (0.1–0.7)
Scalp hair loss	0.7 (0.4–1.2)	1.2 (0.8–1.8)	1.2 (0.6–2.3)

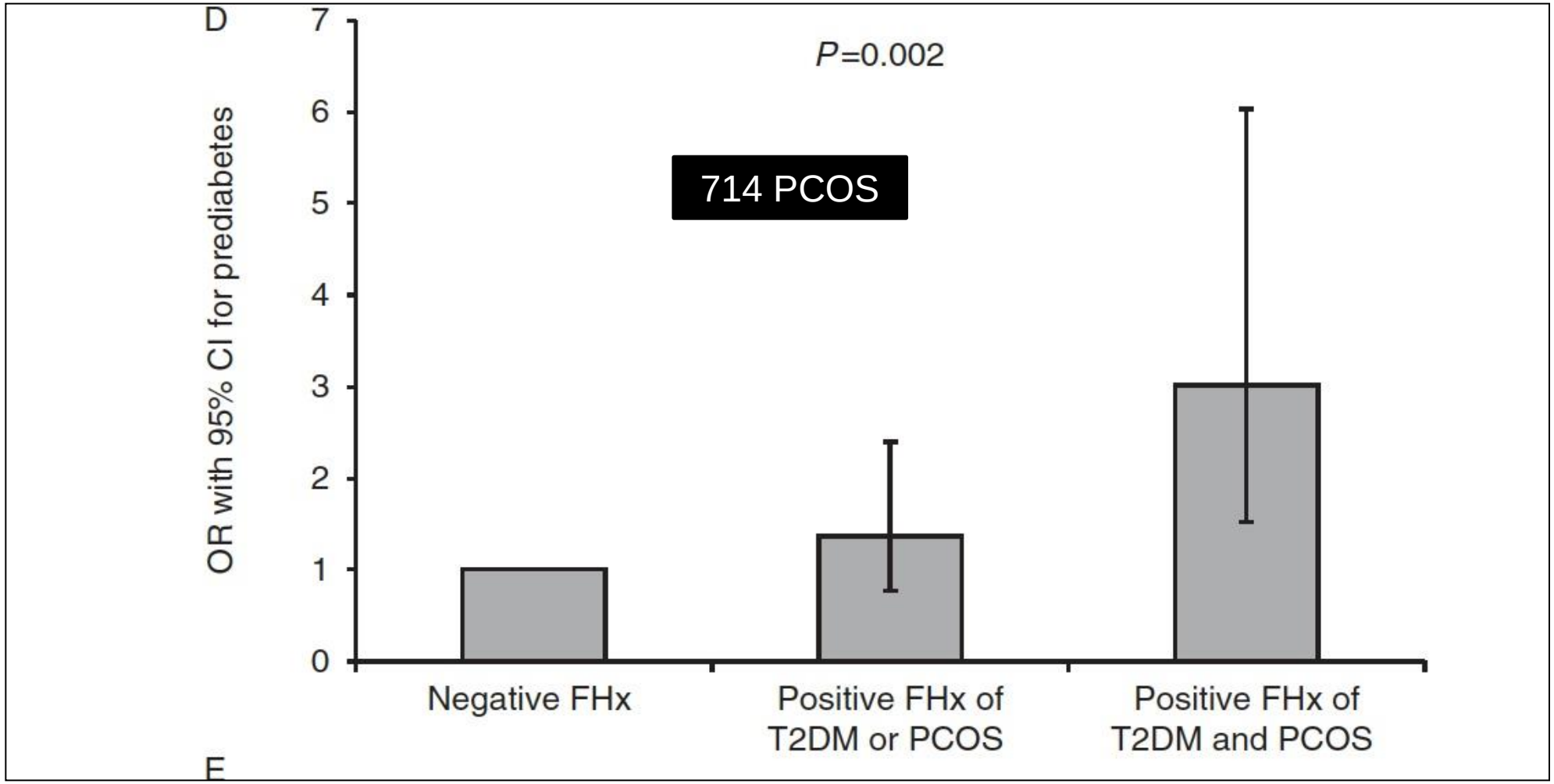
Gibson-Helm et al, J Clin Endocrinol Metab, 2017

β-cell dysfunction in PCOS



Ehrmann et al., J Clin Invest 1995

Prediabetes and Family History DM2/ PCOS



Lerchbaum et al, EJE 2014

Γονίδια & ΣΠΩ

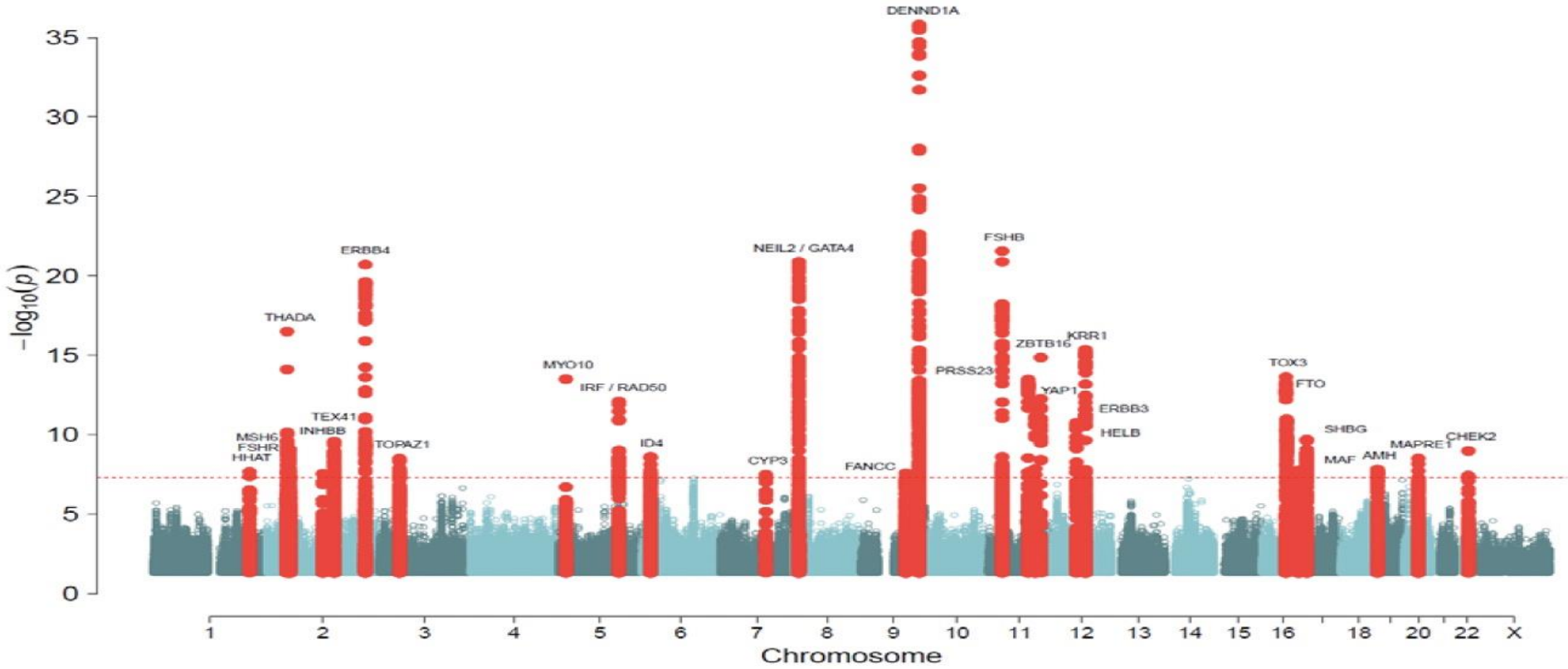


Figure 1. Manhattan plot showing the 29 genomic loci associated with PCOS. *Variants within 300kb on either side of a genome-wide significant signal are highlighted in red. The dotted line indicates the genome-wide significance level. Gene names indicate the consensus PCOS gene at each locus.*

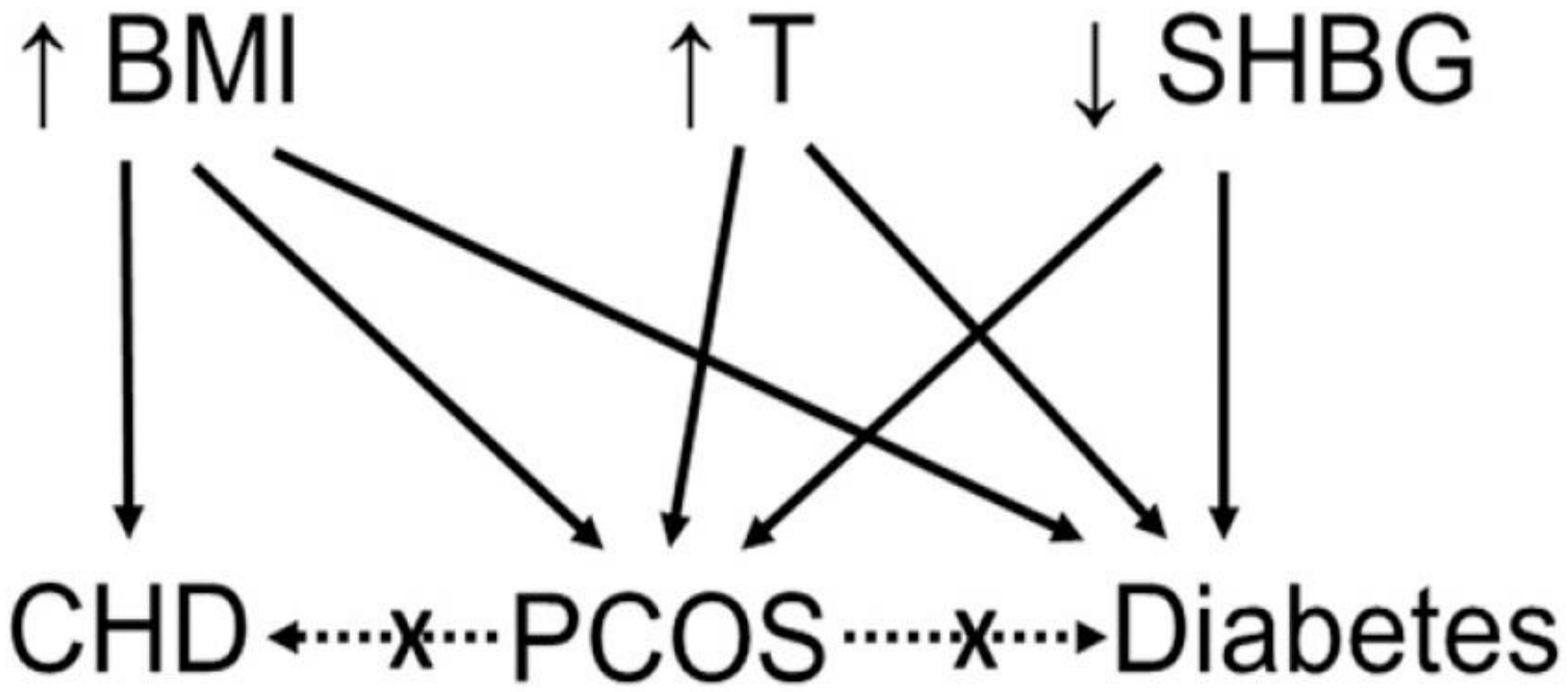
Relationships among risk factors, PCOS, and cardiometabolic events suggested by Mendelian randomization study

- In a GWAS meta-analysis of PCOS consisting of 10,074 PCOS case and 103,164 control subjects of European ancestry.

- DIAbetes Meta-ANalysis of Trans-Ethnic association studies (DIAMANTE) consortium, which included 74,124 case and 824,006 control subjects of European ancestry.

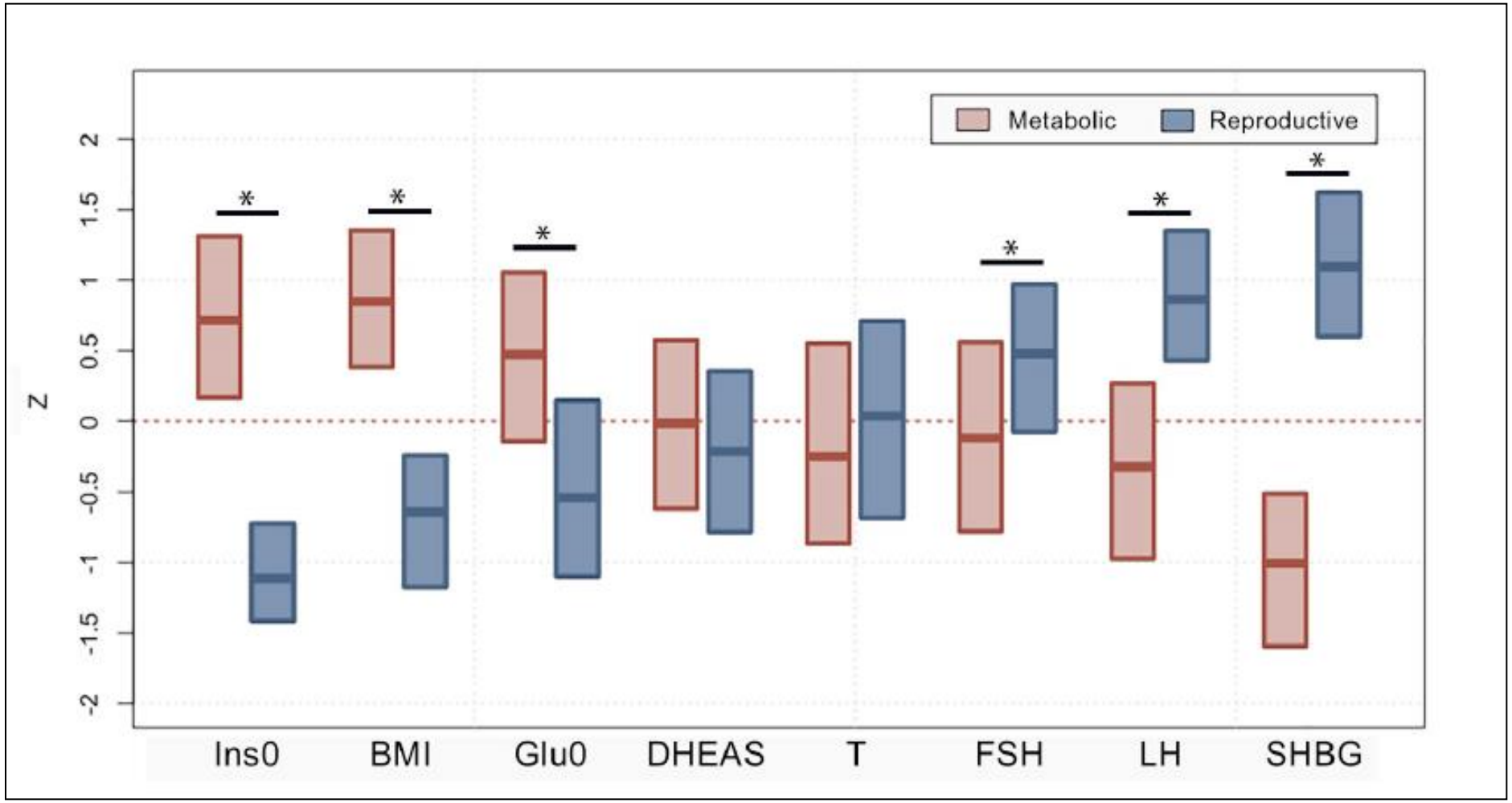
Zhu et al. Diabetes 2021

DM2 & PCOS relationship



Zhu et al, Diabetes 2021

Distinct subtypes of PCOS with novel genetic associations



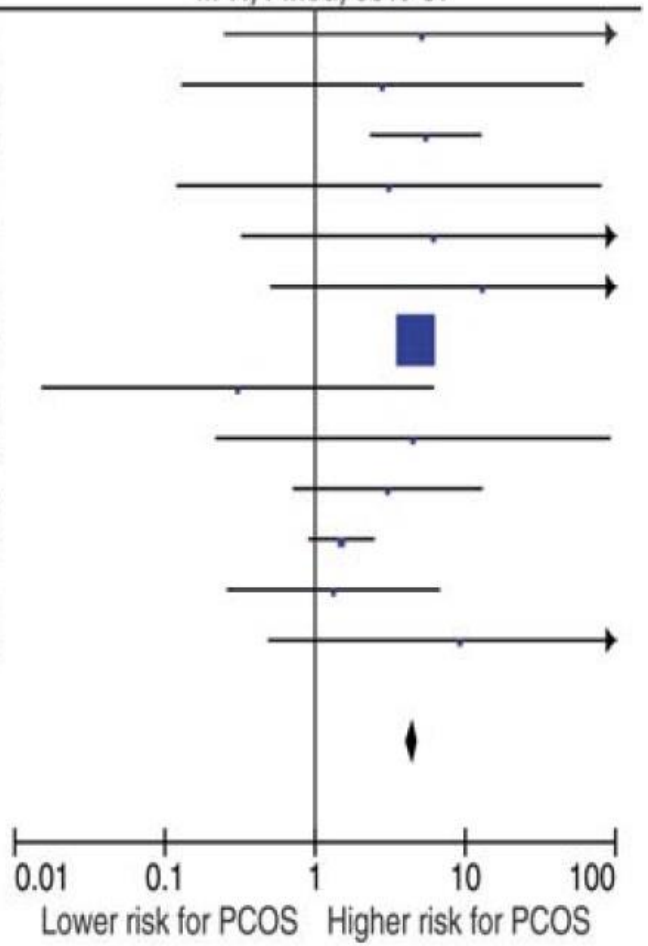
Dapas et al, PLOS 2020

DM2 prevalence in women with and without PCOS

Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI	Year
Dos Reis 1995	3	29	0	19	0.1%	5.15 [0.25, 105.59]	1995
Rajkhowa 1996	2	72	0	39	0.2%	2.80 [0.13, 59.82]	1996
Cibula 2000	9	28	60	752	0.8%	5.46 [2.37, 12.60]	2000
Yarali 2001	1	30	0	30	0.1%	3.10 [0.12, 79.23]	2001
Sir-Petermann 2004	4	146	0	97	0.2%	6.16 [0.33, 115.68]	2004
Sawathiparnich 2005	3	6	0	6	0.1%	13.00 [0.51, 330.48]	2005
Lo 2006	988	11035	1136	55175	89.9%	4.68 [4.28, 5.11]	2006
Alvarez-Blasco 2006	0	32	3	72	0.6%	0.31 [0.02, 6.09]	2006
Leibel 2006	3	36	0	21	0.1%	4.49 [0.22, 91.35]	2006
Marquez 2008	6	50	3	70	0.6%	3.05 [0.72, 12.82]	2008
Shaw 2008	34	104	70	286	6.6%	1.50 [0.92, 2.45]	2008
Bhattacharya 2009	6	264	2	116	0.7%	1.33 [0.26, 6.67]	2009
Moini 2009	4	273	0	276	0.1%	9.23 [0.49, 172.33]	2009
Total (95% CI)		**12105**		**56959**	**100.0%**	**4.43 [4.06, 4.82]**	
Total events	1063		1274				

Heterogeneity: $Chi^2 = 26.82$, $df = 12$ ($P = 0.008$); $I^2 = 55\%$

Test for overall effect: $Z = 33.93$ ($P < 0.00001$)



B

Moran et al, Human Reproduction Update, 2010

Επίπτωση δυσγλυκαιμίας σε γυναίκες με ΣΠΩ

Author, year	Subjects nr	Country	PCOS	T2D criteria	Age (years)	BMI (kg/m^2)	IFG (%)	IGT (%)	T2D (%)
Legro, 1999 [74]	254	USA	NIH	WHO	14-44	32±3	?	31	7.5
Ehrmann, 1999 [60]	122	USA	NIH	ADA	25±0.7 (13-40)	30-43	9	35	10
Gambineri, 2004 [3]	121	Italy	Rotterdam	WHO	14-37	20-38	?	15.7	2.5
Mohlig, 2006 [62]	264	Germany	NIH	WHO	28±0.4	30±0.4	?	14.3	1.5
Dabadghao, 2007 [61]	372	Australia	Rotterdam	ADA	30±5 (15-62)	35±8	3	15.6	4
Seneviratne, 2009 [18]	168	Sri Lanka	Rotterdam	WHO	29±4 (20–40)	25.92 (16-39)	?	23.2	10.1
Lee, 2009 [51]	194	Korea	Rotterdam	ADA	27±5	24±4	17		1
Wei, 2009 [52]	356	Chin	Rotterdam	WHO	32±4 (19-44)	22±4.2	?	7.6	3,1
Zhao, 2010 [139]	818	China	Rotterdam	ADA	25±5	?	8.5	35.4	4
Celik, 2013 [71]	252	Turkey	Rotterdam	ADA	24±5	26±5.7	?	14.3	2
Lerchbaum, 2014 [141]	714	Austri	Rotterdam	ADA	27 (23-32)	24.2 (21-30)	12.8		1.5
Vrbikova, 2014 [134]	330	Chec	Rotterdam	ADA	27.8±7	27.6±6	12	8.8	3
Amato, 2015 [25]	241	Ital	Rotterdam	WHO	24±6 (14-43)	30±6n(18-50)	11.6	5.4	1.7
Ganie, 2015 [17]	2014	India	Rotterdam	ADA	23±5.4	25±4.4	14.5	5.9	6.3
Gracelyn, 2015 [142]	200	India	Rotterdam	ADA	16-40	?	?	14.5	1.5
Li, 2016 [143]	2436	China	Rotterdam	ADA	27	21.56	13.5	19.8	3.9
Ollila, 2017 [117]	265	Finland	Rotterdam	WHO	46	28.6± 6	?	?	12.4
Pelanis, 2017 [16]	876	Sweden	Rotterdam	ADA	29 (25-34)	28 (23-33)	11	12	3
Ortiz-Flores, 2019 [144]	400	Spain	Rotterdam	WHO	26 (14-49)	28.6 (22-34)	14	14.5	2.5

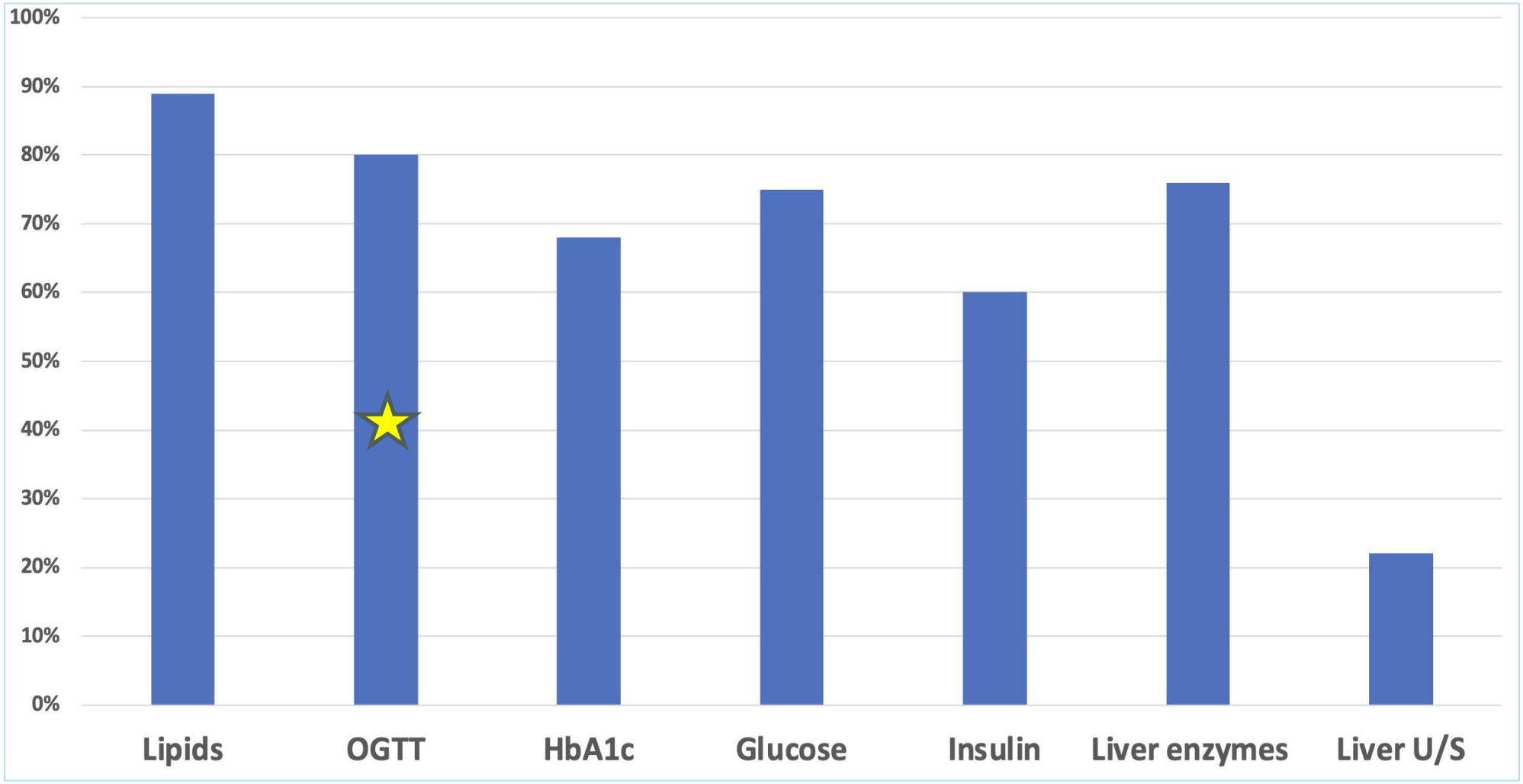
Livadas et al., WJD, 2021

Guidelines regarding OGTT upon diagnosis of PCOS

Guidelines	OGTT recommended upon diagnosis in all women with PCOS	Follow-up OGTT
Joint AACE/ACE and AE-PCOS society	Yes	Yearly in women with IGT Every 1–2 years based on BMI (not specified) and family history of T2D
Australian NHMRC	No recommended if one or more BMI > 25kg/m2 or in Asians > 23kg/m2, history IFG, IGT, GDM, family history of diabetes mellitus type 2, hypertension or high-risk ethnicity	every one to three years, based on presence of other diabetes risk factors.
Endocrine Society	Yes	Every 3–5 years Sooner if additional risk factors for T2D**
Royal College of Obstetricians and Gynecology	No Recommended if one or more: BMI ≥ 25 kg/m2, age ≥ 40 years, previous gestational diabetes or family history of T2D	Annually in women with IGT or IFG
AE-PCOS Society	No Recommended if one or more: BMI ≥ 30 kg/m2, age ≥ 40 years, previous gestational diabetes or family history of T2D	Every two years in women with risk factors*** Sooner if additional risk factors for T2D develop***
ESHRE and ASRM	No Recommended if BMI ≥ 27 kg/m2	Not specified

Livadas, Diagnostics 2023

How do you perform metabolic assessment at diagnosis? (%)



Livadas, European Journal of Endocrinology, 2024

HbA1C - Προβληματισμοί

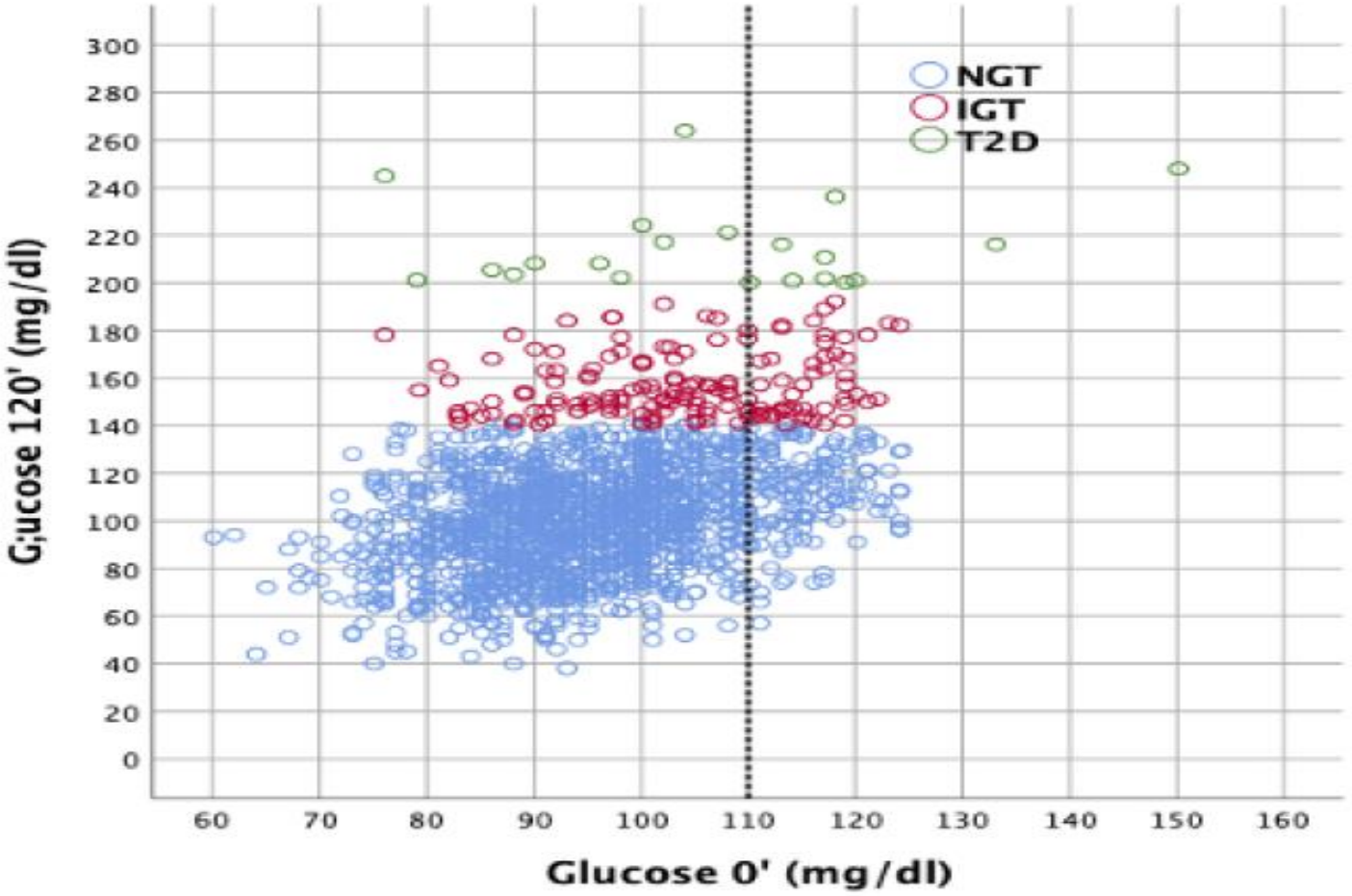
- **Λόγω του ακανόνιστου κύκλου (αραιο- συχνομηνόρροια) συνυπάρχουν σημαντικές αλλαγές αιματοκρίτη - φερριτίνης στο ίδιο άτομο => αναξιόπιστη την αξιολόγηση της HbA1C**
- **Σε δυο μικρότερες μελέτες PCOS δεν φάνηκε αποτελεσματική**
- **Ο ρόλος της HbA1c στη διάγνωση της δυσγλυκαιμίας έχει αμφισβητηθεί σε υπέρβαρα και παχύσαρκα άτομα, τα οποία αποτελούν τη συντριπτική πλειοψηφία του πληθυσμού PCOS**

Solomon A et al, BMC Hematology 2019 , Celik C et al, Human Reproduction 2013, Velling Magnussen L et al, Fertility and Sterility 2011, Chatzianagnostou K. Clinical Endocrinology 2019

Can dysglycemia in OGTT be predicted by baseline parameters in patients with PCOS?

- 1614 PCOS
- 362 controls

	PCOS	Controls
T2D (%)	2.2	1.1
IGT (%)	9.5	7.5
IFG (%)	12.4	8.9



Livadas et al., Endocrine Connections, 2022

Distribution of subjects with IFG, IGT, DM2 according to BMI and age

Figure 1A: Distribution of PCOS subjects with T2DM (%) according to age group and BMI status.

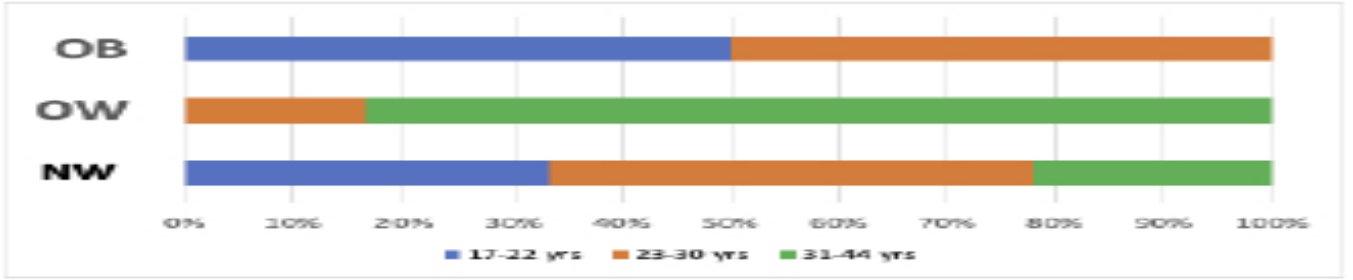


Figure 1B: Distribution of PCOS subjects with IGT (%) according to age group and BMI status.

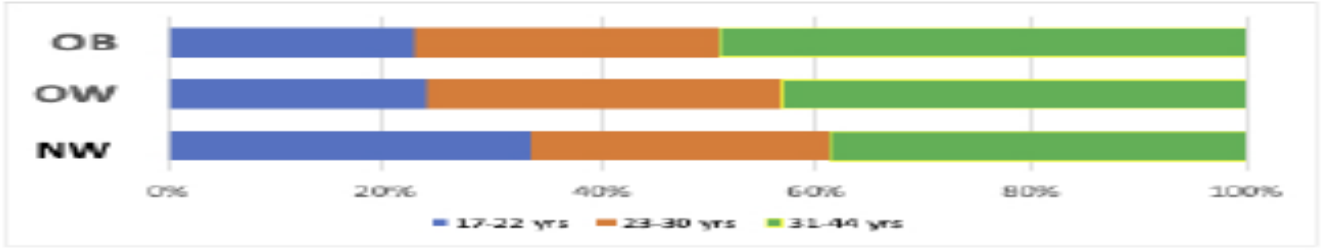
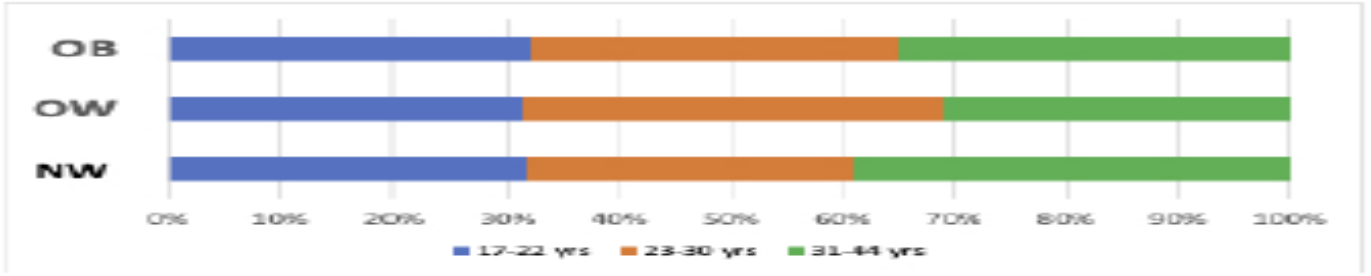


Figure 1C: Distribution of PCOS subjects with IFG (%) according to age and BMI status



Livadas et al., Endocrine Connections, 2022

Development and risk factors of type 2 diabetes in a nationwide population of women with polycystic ovary syndrome

	PCOS OUH (N=1,162)		PCOS Denmark (N=18,477)		Controls (N=54,680)		
	N (%)	Incidence rate per 1,000 PY	N (%)	incidence rate per 1,000 PY	N (%)	incidence rate per 1,000 PY	P^
Total event rates of T2D (GDM included)	115 (10)	9.0	1,621 (9)	8.0	1,274 (2)	2.0	<0.001

	Crude	Adjusted HR
	HR (95% CI)	HR (95% CI)
Outcome: T2D (GDM included)		
PCOS (yes/no)	4.0 (3.7; 4.3)	3.6 (3.4; 4.0)
	P<0.001	P<0.001

IN LEAN COMPARABLE TO CONTROLS

Rubin,JCEM, 2017

Evolution to Diabetes and IGT in PCOS, available literature data

Author/year	n	BMI	Duration of follow-up (years)	Evolution to IGT	Evolution to DM	Insulin levels
Ermann, 1999[8]	25	41	2.4	40%	N/A	N/A
Pasquali R, 1999[9]	21	32	10		N/A	Deterioration
Norman, 2001[10]	67	35-41	6	9.3%	7.4%	N/A

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Norman, 2001[10]	67	35-41	6	9.3%	7.4%	N/A
		27-28		0	0	N/A
Elting, 2001[21]	34	24	15	N/A	2%	Stable
Legro, 2005[18]	35	35	3	16%	N/A	Stable
Brown, 2011[19]	172	26	2.6	0%	0%	Stable
	82	26	5.5	0%	0%	Stable
Schmidt, 2011[20]	35	27.1	21	0%	0%	Stable
Carmina, 2013[22]	118	27	20	N/A	N/A	Stable

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Author/year	n	BMI	Duration of follow-up (years)	Evolution to IGT	Evolution to DM	Insulin levels
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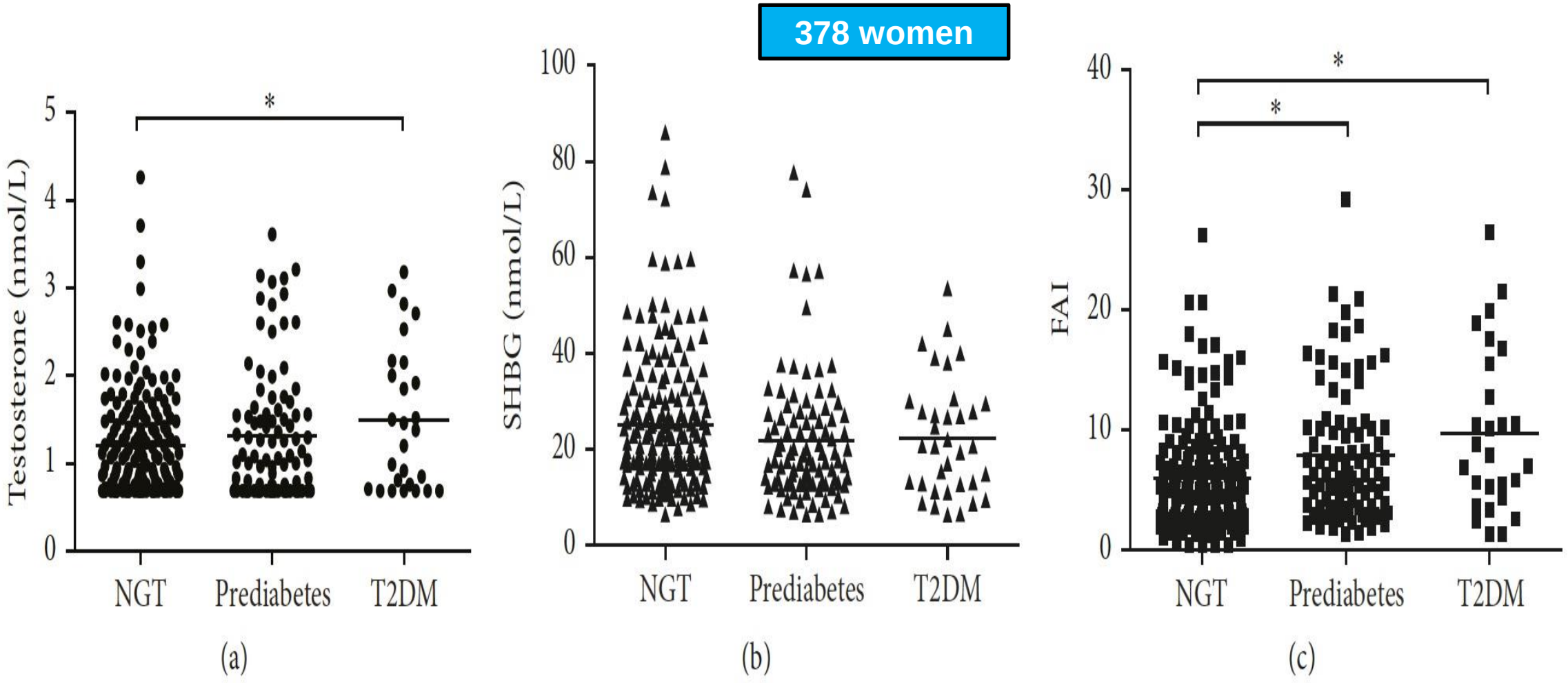
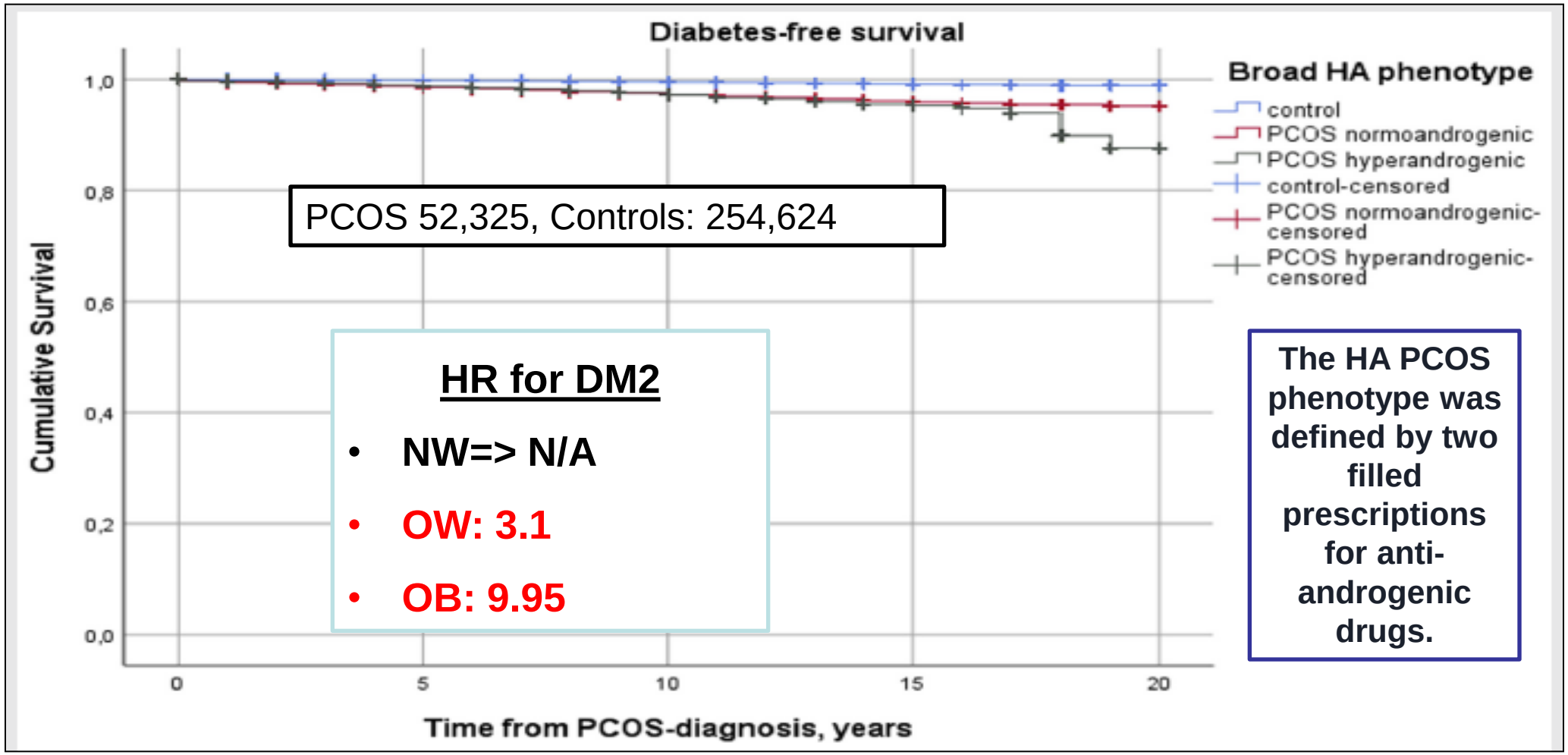
	82	26	5.5	0%	0%	Stable
Schmidt, 2011[20]	35	27.1	21	0%	0%	Stable
Carmina, 2013[22]	118	27	20	N/A	N/A	Stable
Gambineri, 2012[17]	249		16.9	Total group	39%	N/A
		<25		Incidence rate X 100 person-years	0.25	N/A
		25-30			0.63	N/A
		>30			2.02	N/A

Συσχέτιση Υπερανδρογοναιμίας & Δυσγλυκαιμίας σε ασθενείς με ΣΠΩ



Zhang et al, BioMed Research International, 2018

Higher risk of DM2 in hyperandrogenic women with PCOS



Persson et al, Fertil Steril 2021

Βαθμός Υπερανδρογοναιμίας σε ασθενείς με IGT vs. IFG

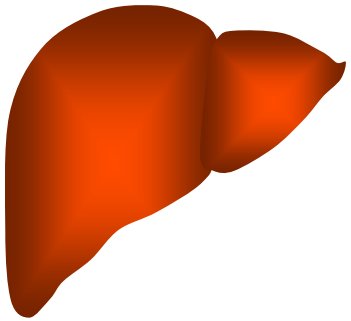
Variable	T2DM	IGT	IFG	NGT
Testosterone (nmol/L)	2.50±0.99 [a]	2.94±1.33 [d,e]	2.38±0.12	2.41±1.43
SHBG (nmol/L)	35.42±22.93 [b,c]	34.52±18.29 [d,e]	63.30±34.81	46.01±29.08
FAI	2.67±0.49 [a,c]	3.46±2.47 [d,e]	2.81±1.86 [f]	1.04±1.30
DHEAS (nmol/L)	3.00±1.64 [a,b,c]	4.15±2.32	3.78±2.01 [f]	4.61±4.06

Livadas et al., Endocrine Connections, 2022

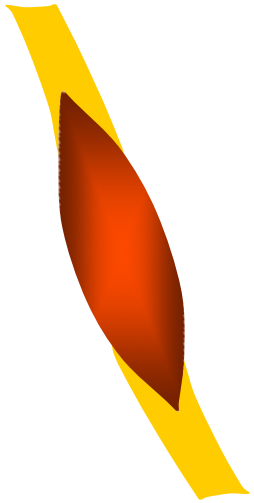
Do patients with IFG represent a different population than patients with IGT?

isolated IFG

IR

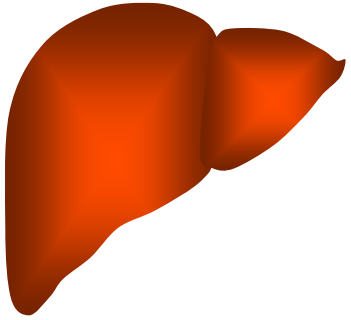


N

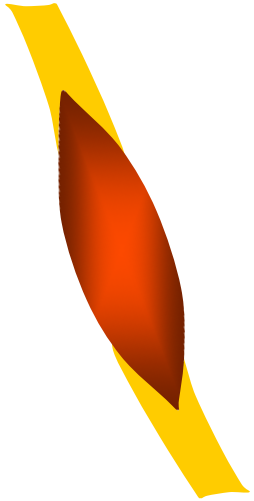


isolated IGT

N



IR



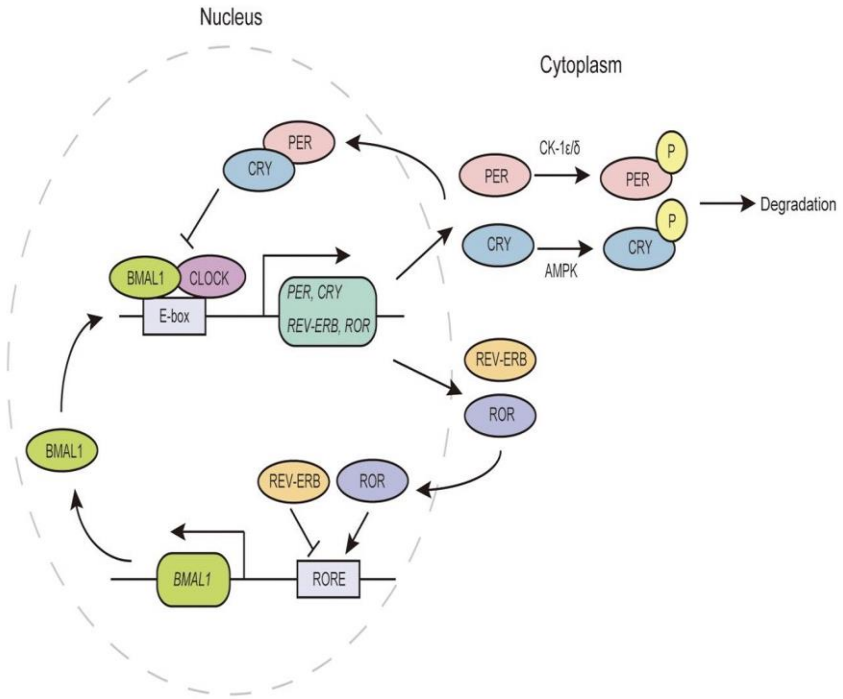
Abdul-Ghani et al. Diabetes Care 2006

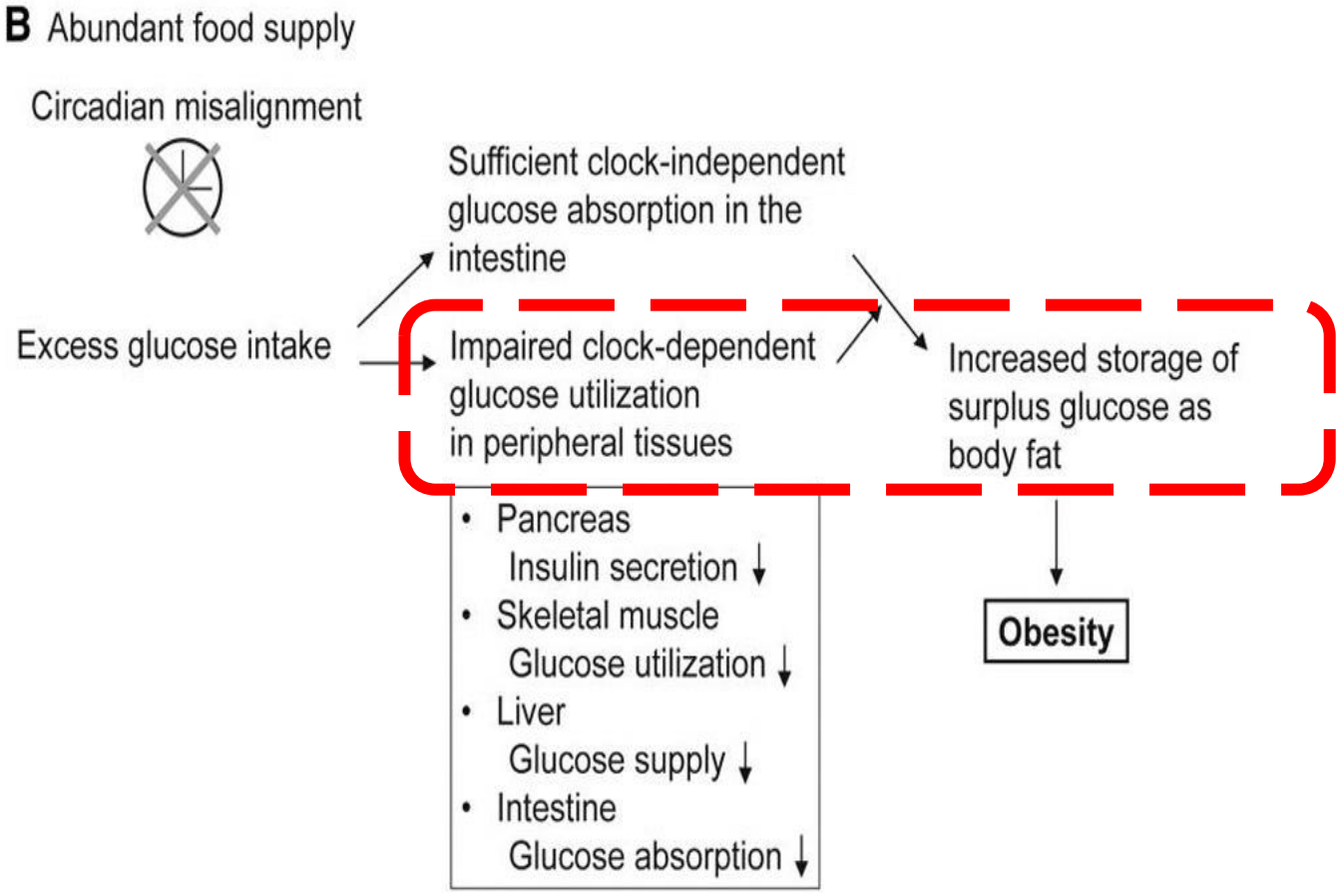
- **Τα ανδρογόνα ελαττώνουν την ευαισθησία των μυών στην ινσουλίνη σε αδύνατες γυναίκες με PCOS**

Hansen SL et al. Journal of Clinical Endocrinology & Metabolism 2019

- **Τα άτομα με IFG μπορεί να είναι επιρρεπή για ΣΔ2**
- **Τα άτομα με IGT μπορεί να περιλαμβάνουν ασθενείς που εμφανίζουν δυσγλυκαιμία λόγω υπερανδρογοναιμίας.**

Circadian Regulatory Networks of Glucose Homeostasis





Onuma, Endocrinology, 2024

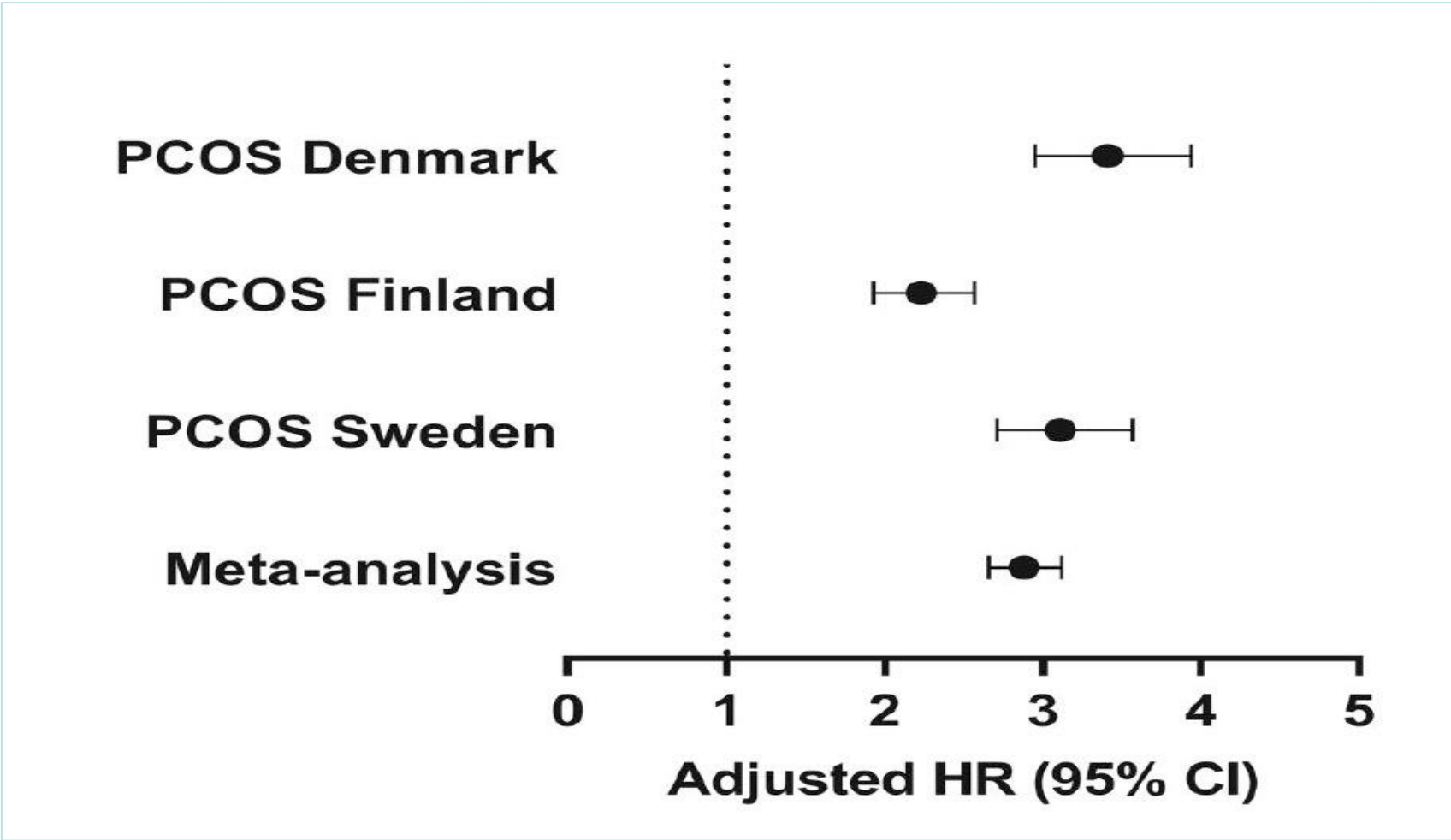
Chronotypes in Polycystic Ovary Syndrome?

Parameters	Morning Chronotype n = 31, 27.7%		Neither Chronotype n = 33, 29.5%		Evening Chronotype n = 48, 42.9%		χ^2	p-Value
BMI categories								
Normal weight (n, %)	22	71.0	2	6.1	0	0	62.91	**<0.001**
Overweight (n, %)	4	12.9	18	54.5	7	14.6	20.04	**<0.001**
Grade I obesity (n, %)	1	3.2	6	18.2	17	35.4	11.89	**0.003**
Grade II obesity (n, %)	4	12.9	7	21.2	24	50.0	19.16	**0.001**
Physical activity								
YES (n, %)	20	64.5	13	39.4	3	6.3	30.45	**<0.001**
NO (n, %)	11	35.5	20	60.6	45	93.8		
Smoking								
YES (n, %)	2	6.5	2	6.1	25	52.1	30.03	**<0.001**
NO (n, %)	29	93.5	31	93.9	23	47.9		
HoMA-IR								
<2.5 (n, %)	30	96.8	26	78.8	19	39.6	30.81	**<0.001**
≥2.5 (n, %)	1	3.2	7	21.2	29	60.4		

A p value in bold type denotes a significant difference ($p < 0.05$). BMI, Body Mass Index; HoMA-IR, homeostasis model assessment-insulin resistance.

Barrea, Nutrients 2022,

Prospective risk of Type 2 diabetes in 99 892 Nordic women with polycystic ovary syndrome and 446 055 controls: national cohort study from Denmark, Finland, and Sweden



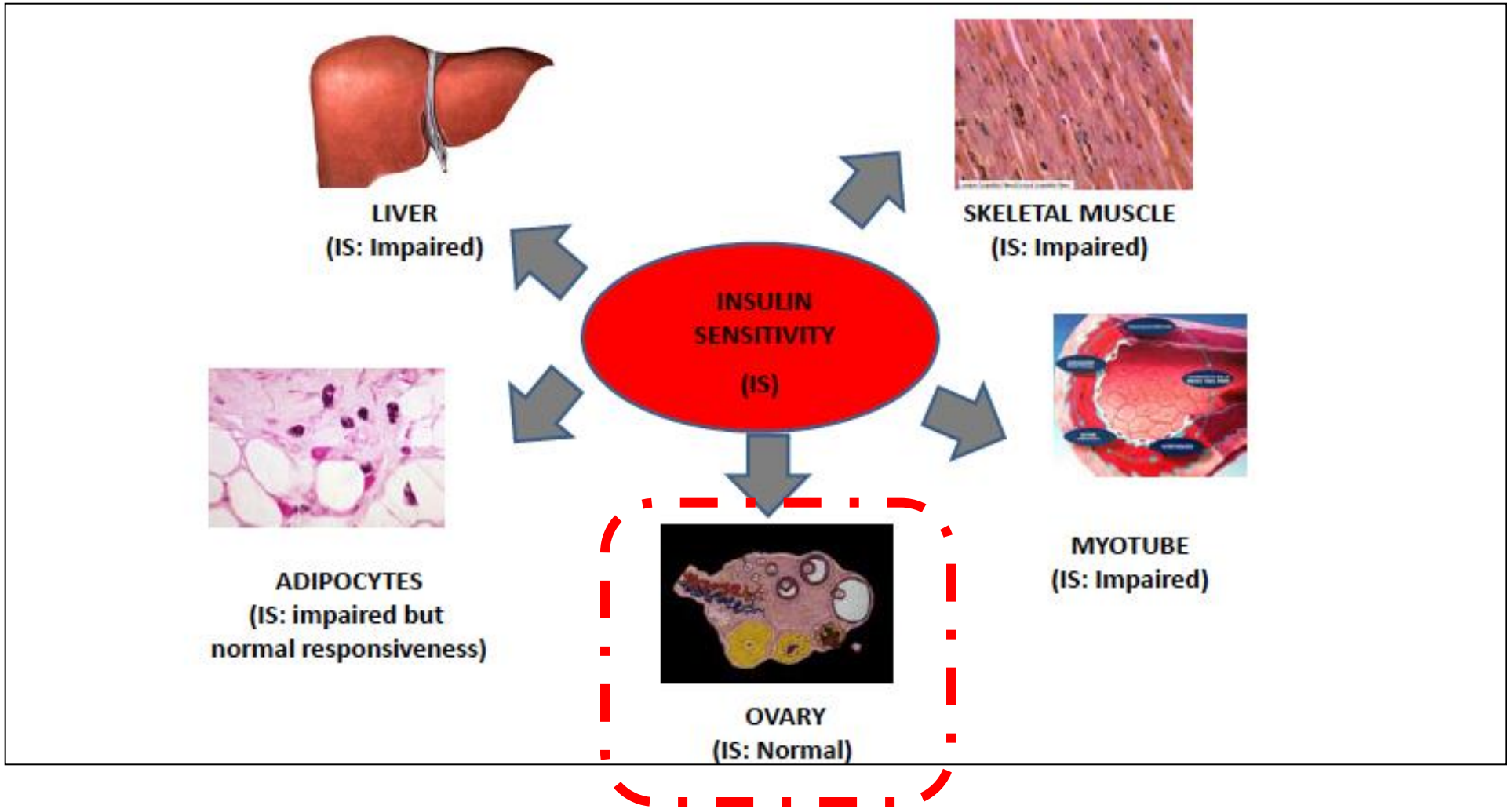
Glintborg, Human Reproduction, 2024

Επίδραση BMI - Εκπαίδευσης

PCOS Denmark	Crude model PCOS	Adjusted 1 PCOS, BMI (groups)	Adjusted 2 PCOS, education	Adjusted 3 PCOS, BMI (groups), education
Subjects in model (N)	159 678	70 491	156 708	69 685
Independent variables				
PCOS (yes vs no)	4.28 (3.98–4.60)	3.49 (3.03–4.02)	4.16 (3.87–4.47)	3.41 (2.95–3.94)
BMI (25.0-29.9 vs <25.0)		3.20 (2.61–3.92)		3.05 (2.48–3.75)
BMI (≥30.0 vs <25.0)		8.42 (7.02–10.09)		7.62 (6.32–9.18)
Education (medium vs low)			0.61 (0.56–0.66)	0.73 (0.60–0.88)
Education (high vs low)			0.36 (0.33–0.39)	0.52 (0.42–0.63)

Glintborg, Human Reproduction, 2024

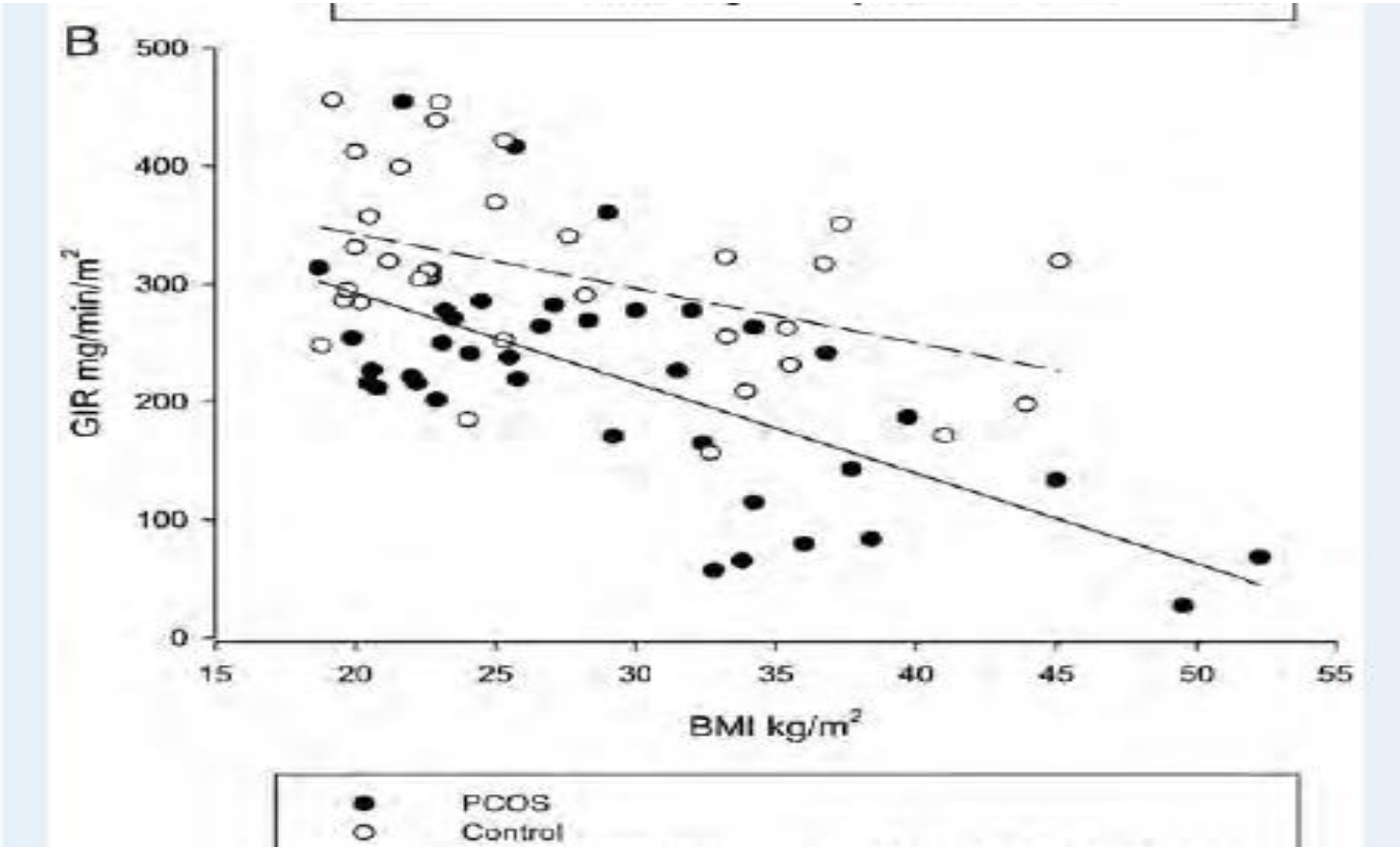
Insulin resistance in PCOS



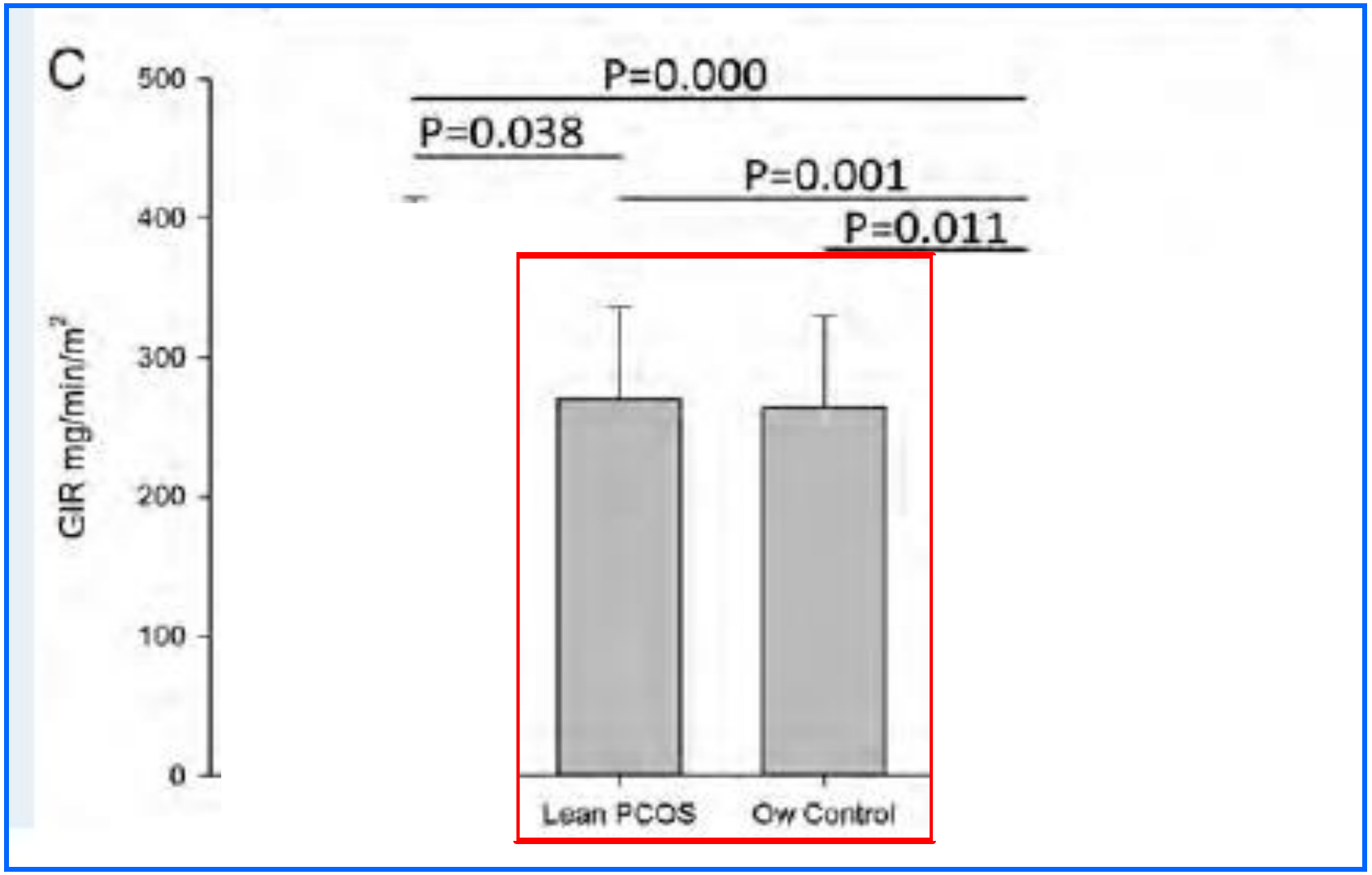
Women with polycystic ovary syndrome have intrinsic insulin resistance on euglycaemic–hyperinsulaemic clamp

Nigel K. Stepto[1,2,3,†], Samantha Cassar[1,†], Anju E. Joham[3], Samantha K. Hutchison[3], Cheryce L. Harrison[3], Rebecca F. Goldstein[3], and Helena J. Teede[3,4,*]

Human Reproduction, Vol.28, No.3 pp. 777–784, 2013

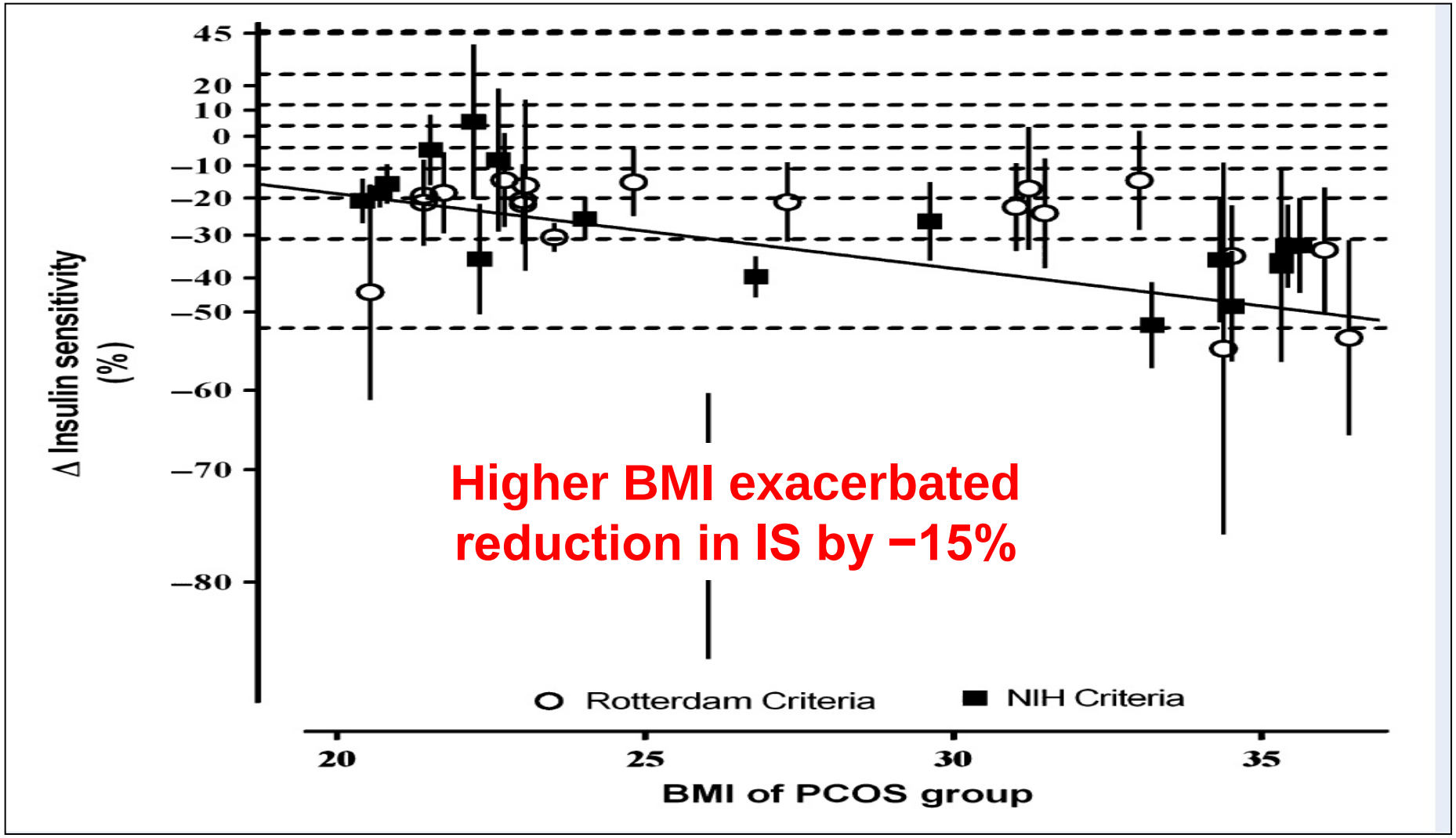


PCOS & Endogenous IR



Stepto et al, Human Reproduction, 2013

BMI & IR



No difference

- **NIH**
- **Rotterdam criteria**

Cassar et al, Human Reproduction, 2016

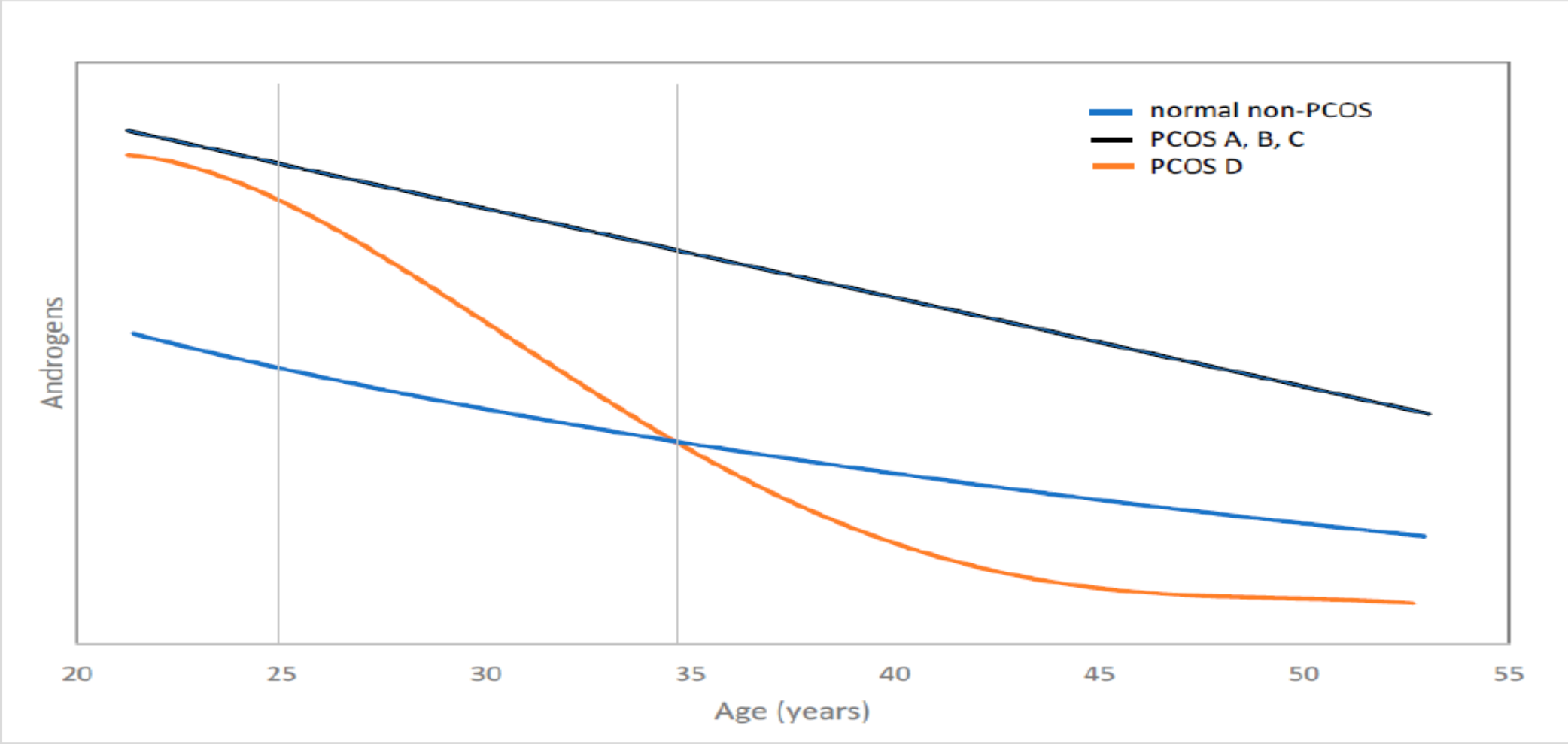
The phenotype of PCOS ameliorates with aging

	Firs	0.5–3.9 y	4.0–7.0
	Patients (n = 254)	Patients (n = 172)	Patients (n = 82)
Mean interval, y		2.6 (0.6–3.9)	
Clinical characteristics			
Age, y	28.6 (24.9–30.9)	31.3 (28.9–33.8)	33.5 (30.4–35.5)
BMI, kg/m^2	26.1 (22.2–31.9)	26.7 (22.5–32.3)	28.2 (23.1–34.2)[a,b]
Amenorrhea	76 (27.4)	47 (25.7)	21 (24.1)
Oligomenorrhea	201 (72.6)	128 (69.9)	62 (71.3)
Regular cycle	0	8 (4.4)[a,c]	4 (4.6)[a,c]
Total no. of follicles	30 (20–42)	33 (23–49)	
PCO	223 (86.1)	145 (85.8)	71 (85.5)
Ovarian volume, mL	9.2 (6.8–12.6)	9.1 (6.9–13.2)	9.4 (6.8–12.1)
Endocrine characteristics			
LH, mIU/mL	6.8 (4.5–10.0)	6.9 (4.5–10.4)	6.2 (3.9–9.0)
FSH, mIU/mL	4.8 (3.4–6.1)	5.3 (3.7–6.9)[a,b]	5.4 (3.7–7.1)[a,b,d]
LH/FSH	1.6 (1.0–2.1)	1.4 (0.9–2.7)	1.1 (0.8–1.7)[a,b]
E_2, pg/L	59.4 (43.3–81.4)	61.6 (45.2–90.7)	58.0 (46.0–82.5)
AMH, ng/mL	11.2 (6.5–16.4)	9.6 (4.8–15.9)	9.5 (5.2–17.3)
Glucose, mg/dL	73.9 (66.7–81.1)	73.9 (66.7–88.1)	77.5 (70.3–86.5)[a,d,e]
Insulin, μIU/mL	9.9 (6.2–15.6)	8.6 (5.8–12.8)[a,b]	9.8 (5.3–15.1)
HOMA score	1.8 (1.1–3.0)	1.5 (1.0–2.4)[a,b]	1.8 (0.9–2.9)
IR	33 (13.0)	13 (8.1)[a,b]	11 (13.6)
T, ng/mL	60.5 (40.3–80.7)	49.0 (31.7–72.0)[a,c]	49.0 (31.7–74.9)[a,b]
SHBG, μg/dL	1.1 (0.7–1.8)	1.0 (0.7–1.7)	1.0 (0.7–1.4)
FAI score	4.8 (3.1–9.4)	4.2 (1.9–8.5)[a,b]	4.5 (2.7–8.0)[b,d]
Androstenedione, ng/dL	346.7 (243.6–464.2)	292.3 (226.6–372.5)	269.3 (200.6–398.3)
DHEA, ng/mL	10.2 (7.3–14.4)	10.1 (3.3–53.8)	10.9 (1.9–25.8)
DHEAS, μg/mL	2.0 (1.5–2.6)	1.7 (1.1–2.3)[a,c]	1.6 (1.1–2.2)[a,c]
HA	149 (58.7)	84 (49.7)	42 (52.5)

Brown. The phenotype of PCOS ameliorates with aging. Fertil Steril 2011.

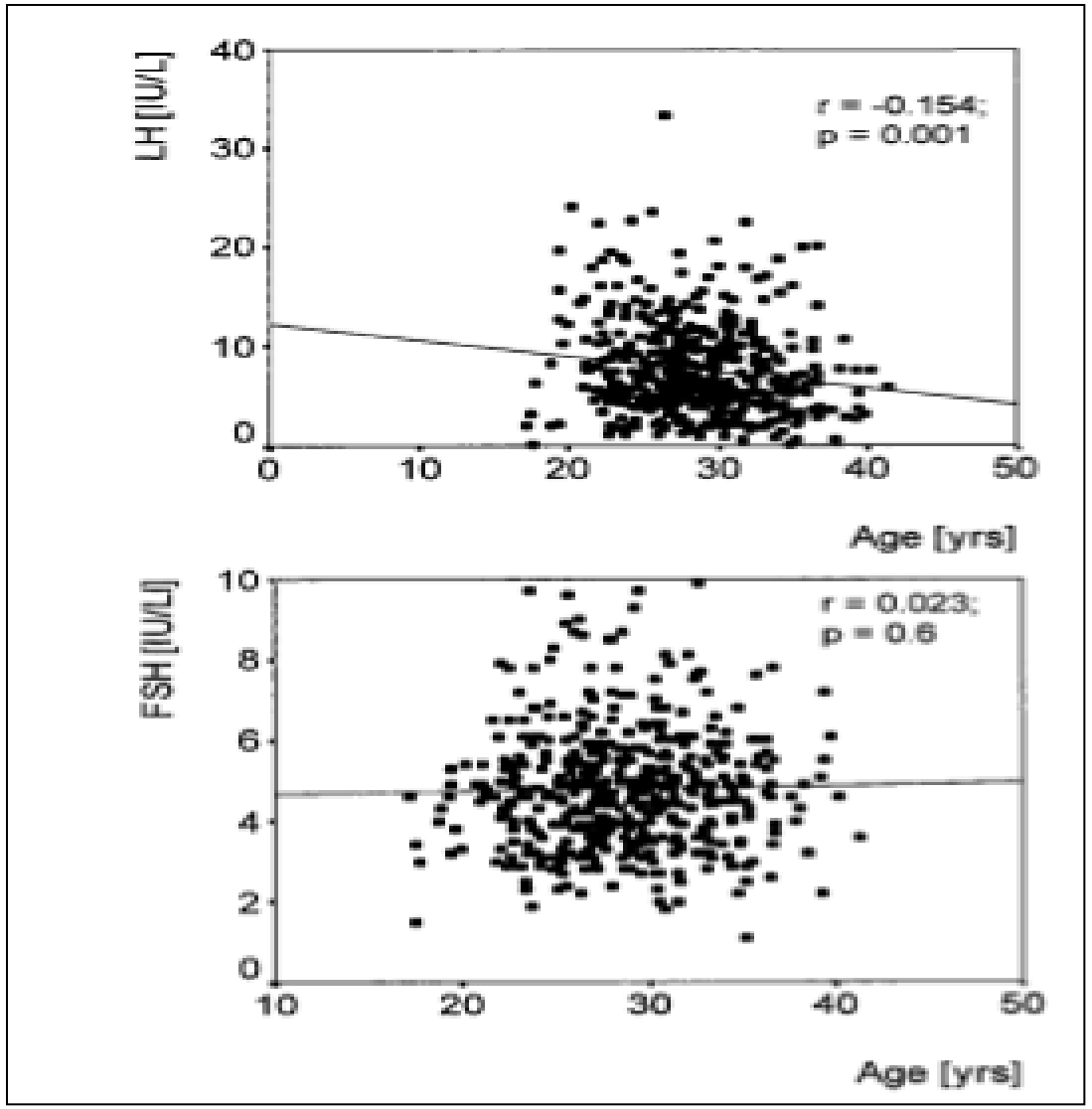
Androgen decline with advancing age

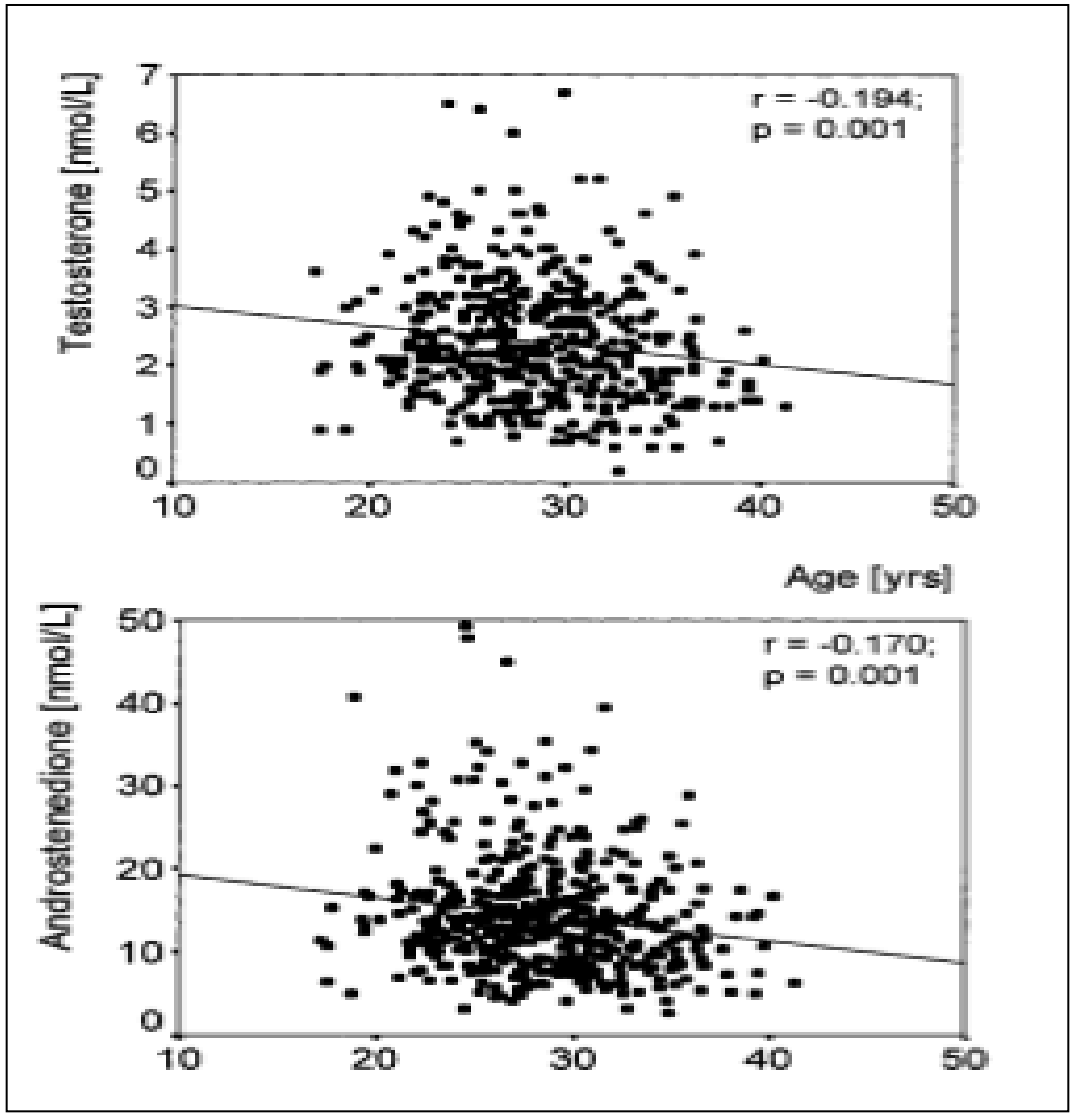
in PCOS and non-PCOS women



Gleicher et al, Biomedicines, 2022

Gonadotropins, Androgens variation through time

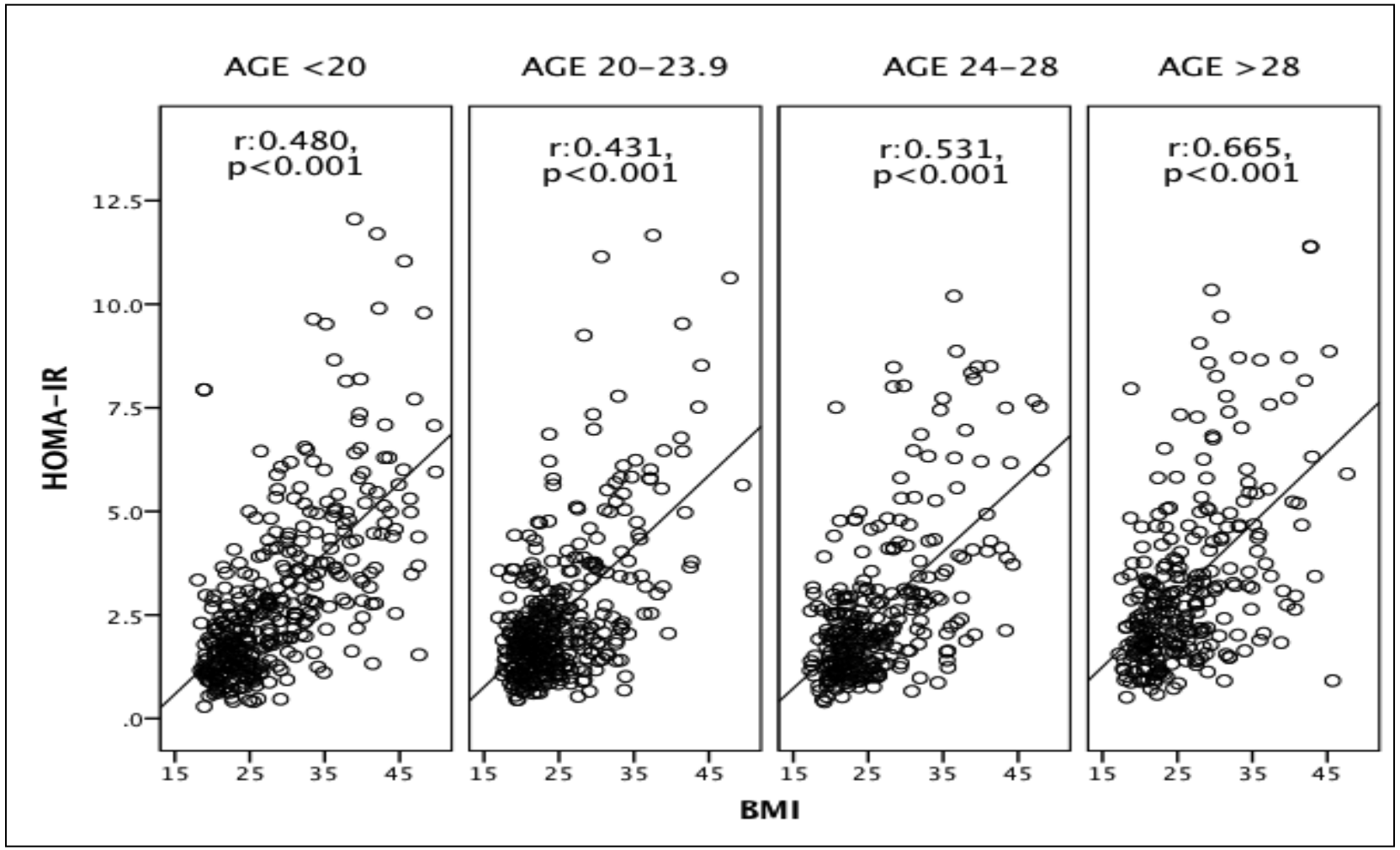




Bili, European Journal of Endocrinology 2001

IR & BMI association

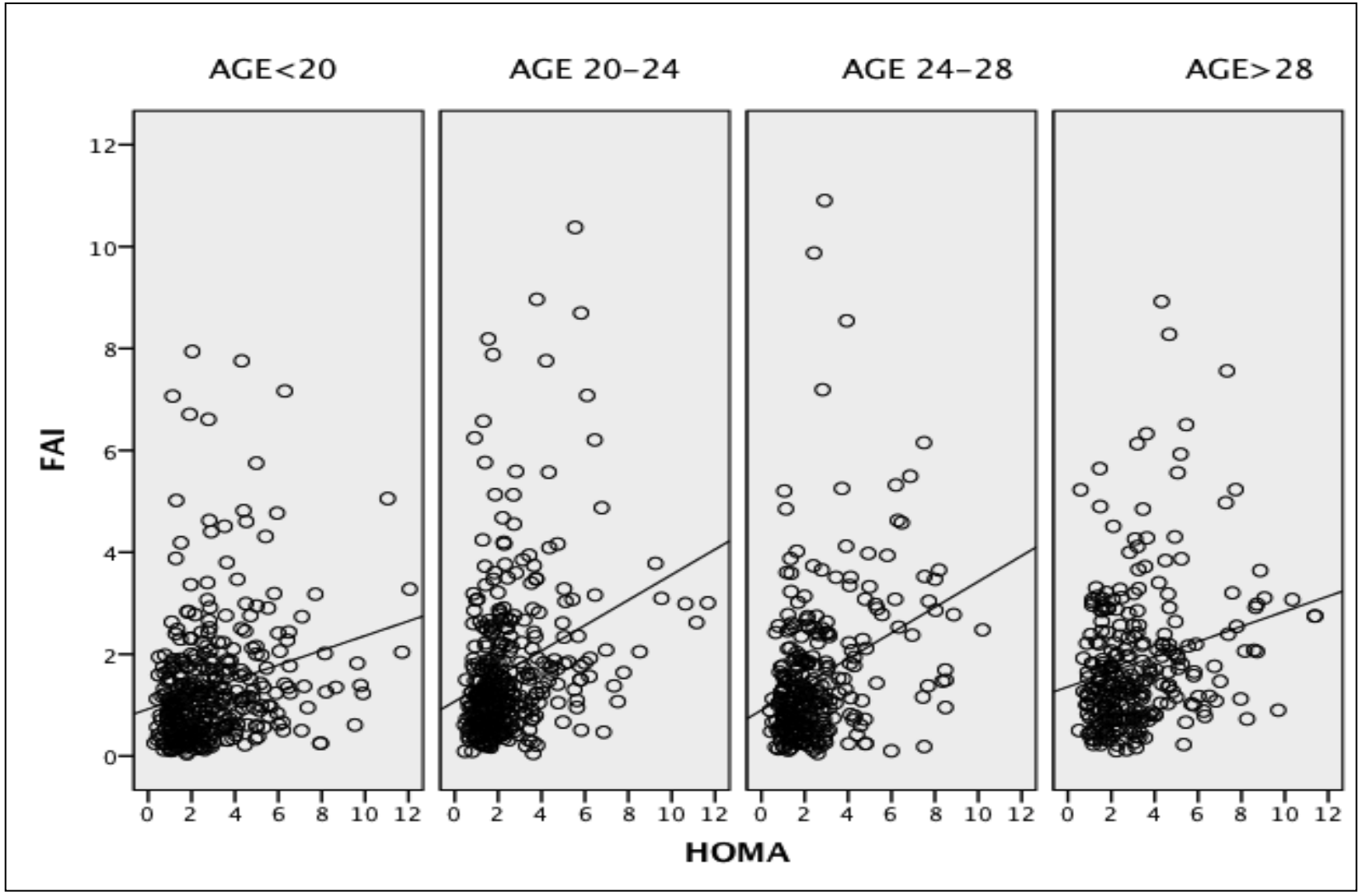
n:1345 PCOS



Livadas et al, EJE 2015

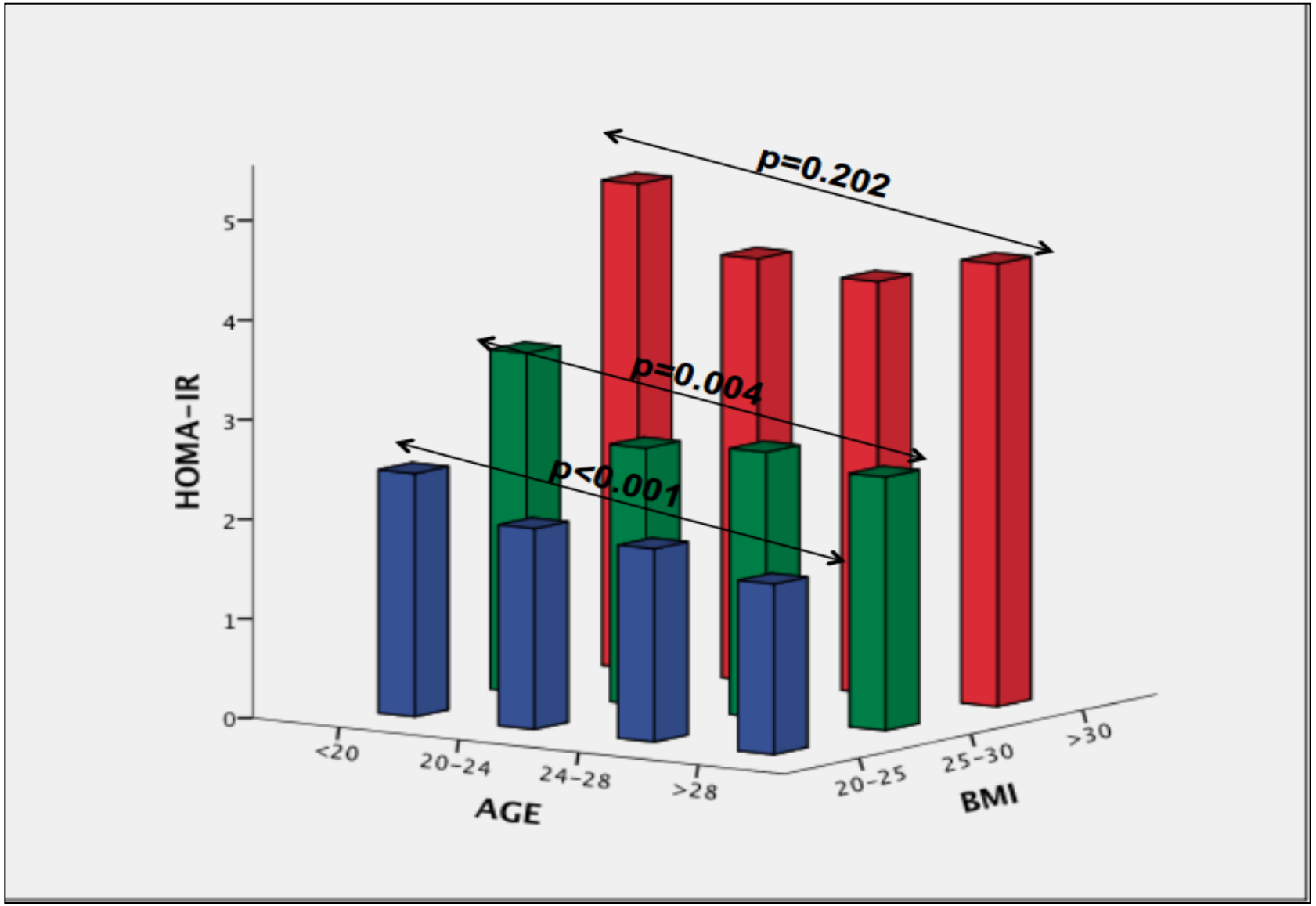
IR & Androgens association

n:1345 PCOS



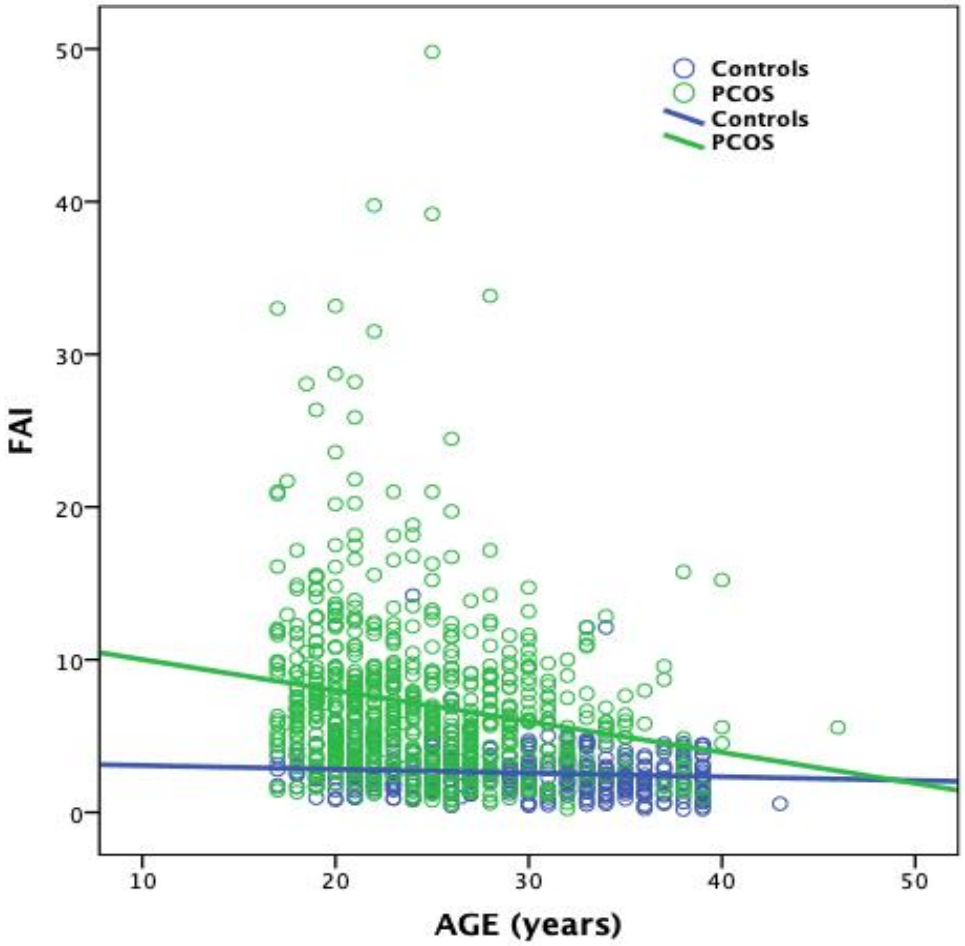
Livadas et al, EJE 2015

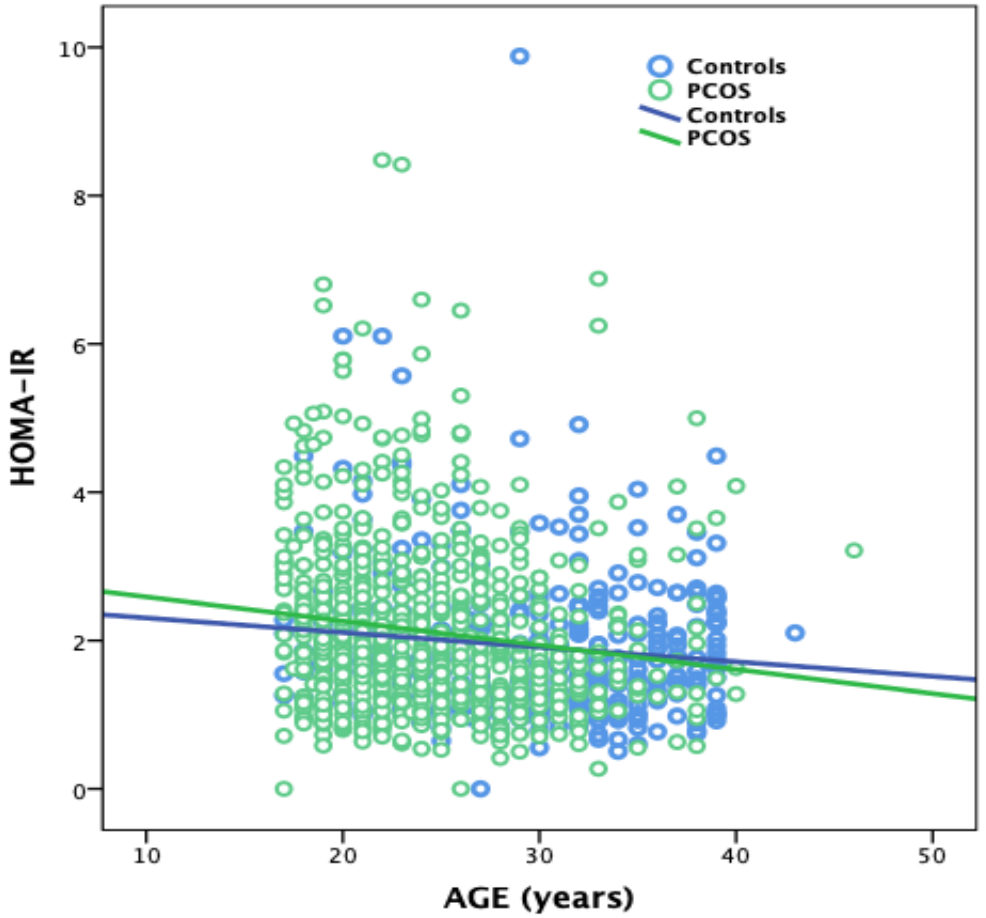
IR & Age association, according to BMI



Livadas et al, EJE 2015

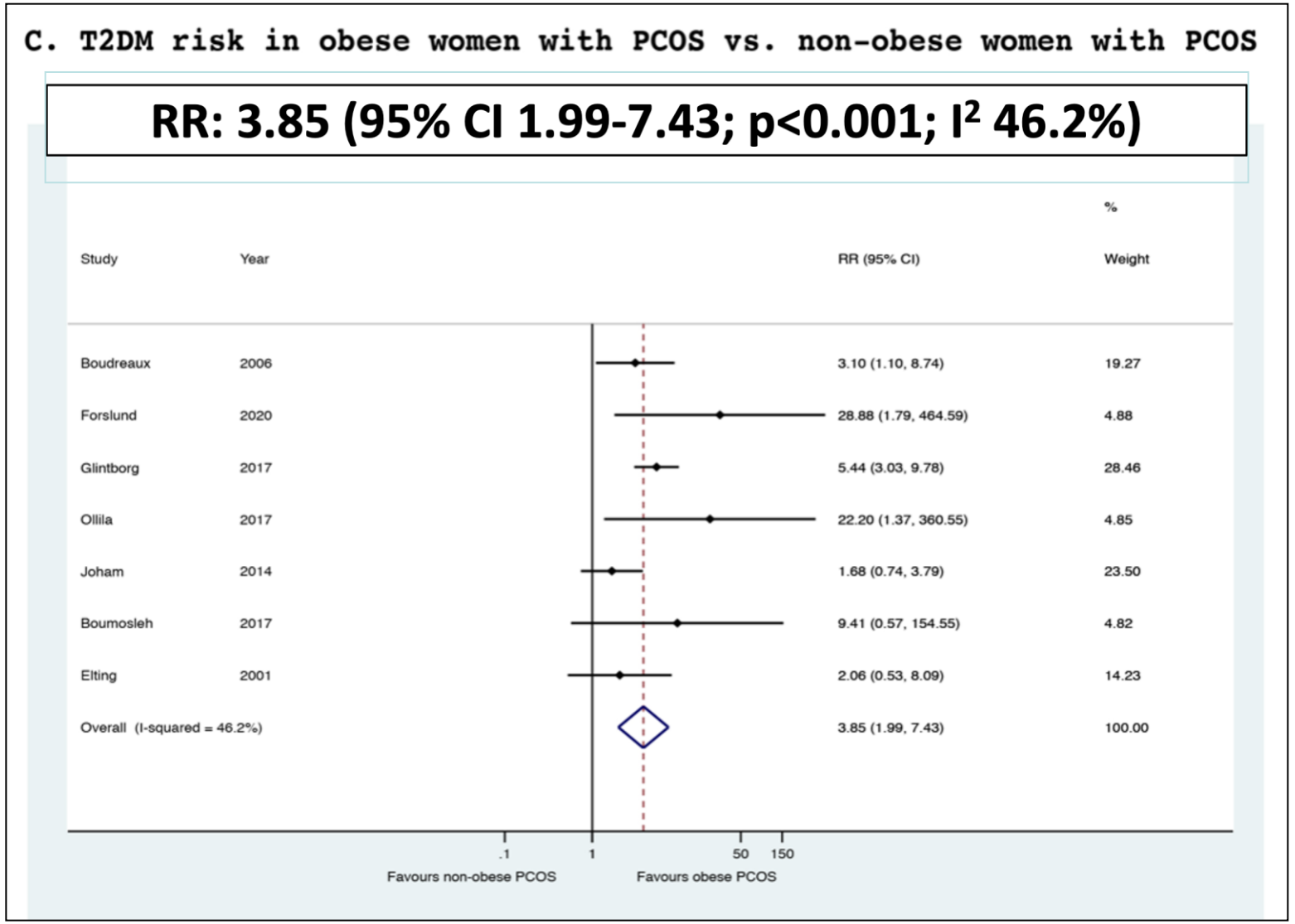
Gradual decrease of FAI & HOMA-IR in normal weight women with PCOS





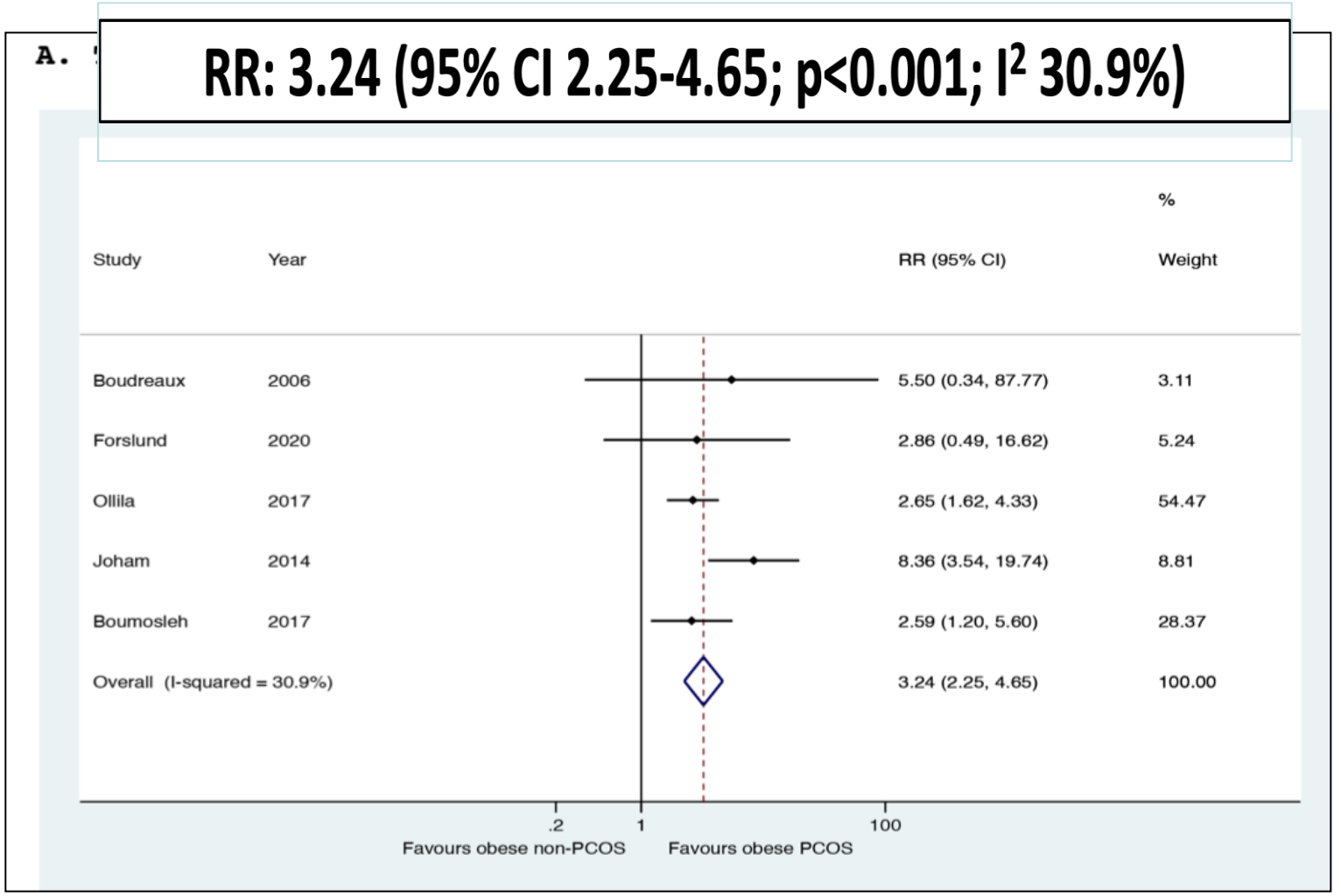
Livadas et al., Hormones 2020

DM2 risk in obese PCOS vs. non-obese PCOS



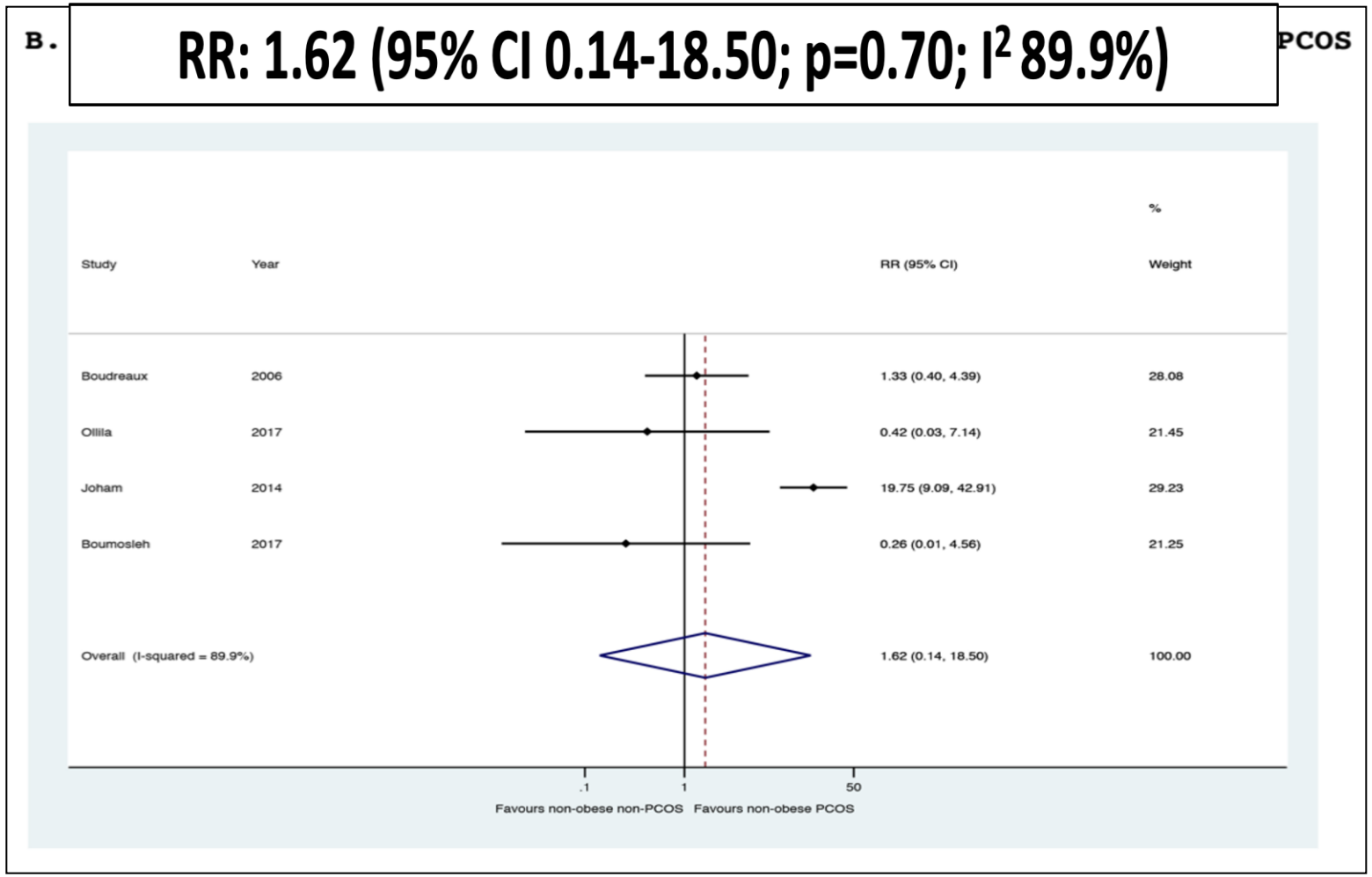
Anagnostis et al., Endocrine, 2021

DM2 risk in obese PCOS vs. obese controls



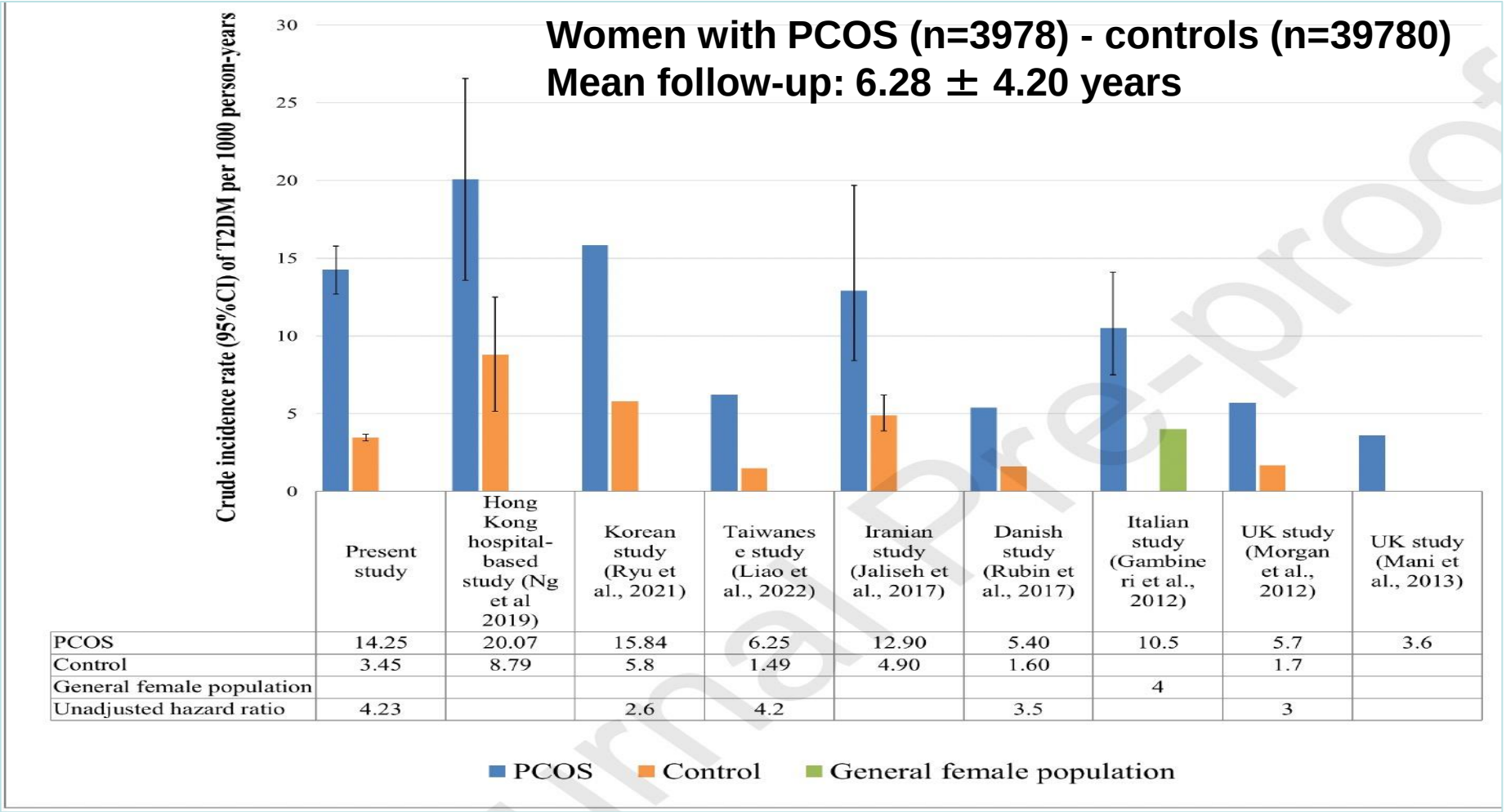
Anagnostis et al., Endocrine, 2021

DM2 risk in non-obese PCOS vs. non-obese controls



Anagnostis et al., Endocrine, 2021

Comparison of crude incidence rate of T2DM per 1000 person-years in different accessible longitudinal studies.

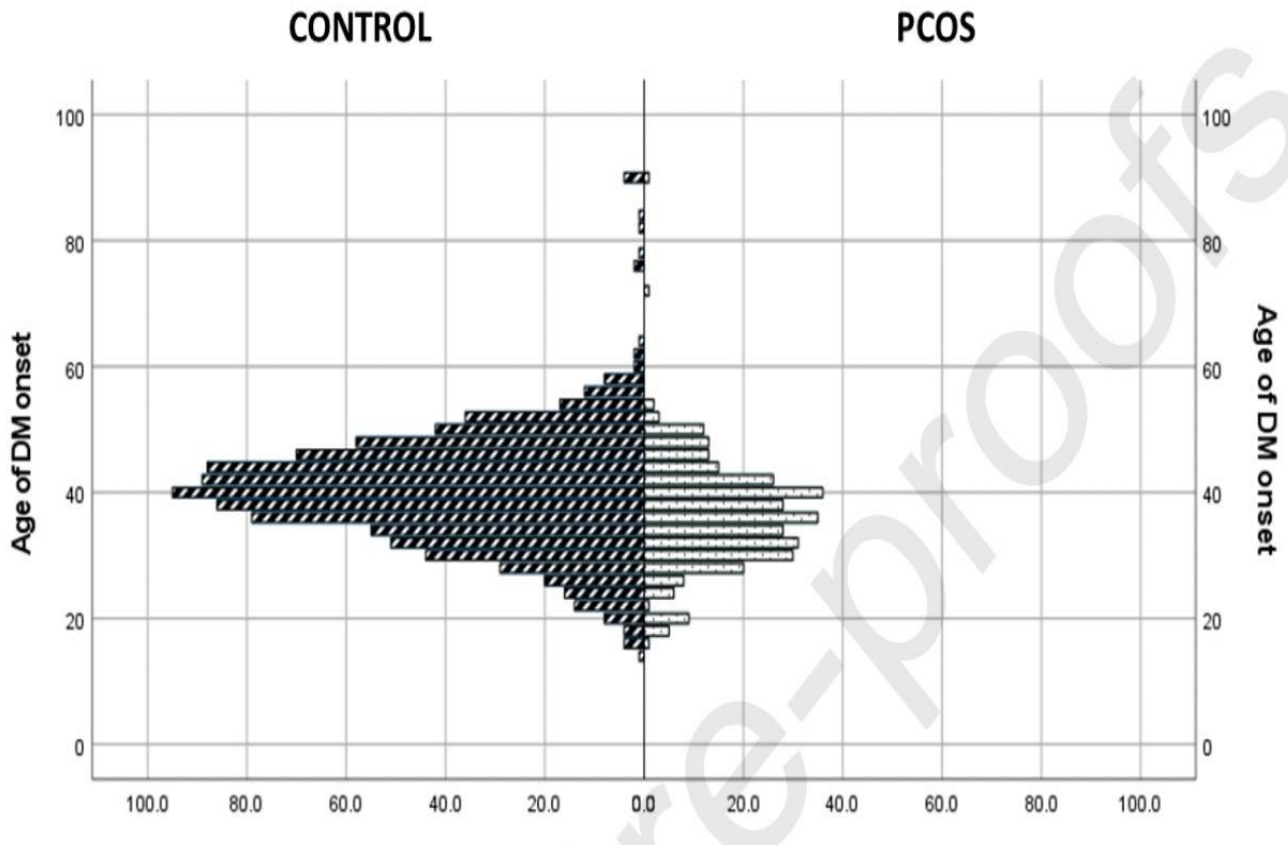


	Present study	Hong Kong hospital-based study (Ng et al 2019)	Korean study (Ryu et al., 2021)	Taiwanese study (Liao et al., 2022)	Iranian study (Jaliseh et al., 2017)	Danish study (Rubin et al., 2017)	Italian study (Gambineri et al., 2012)	UK study (Morgan et al., 2012)	UK study (Mani et al., 2013)
PCOS	14.25	20.07	15.84	6.25	12.90	5.40	10.5	5.7	3.6
Control	3.45	8.79	5.8	1.49	4.90	1.60		1.7	
General female population							4		
Unadjusted hazard ratio	4.23		2.6	4.2		3.5		3	

Ng, Diabetes Research and Clinical Practice, 2023

The age distribution of diabetes onset between women with and without PCOS cohort

Hazard ratio in PCOS was 4.23 (95% CI: 3.73-4.80, p<0.001)



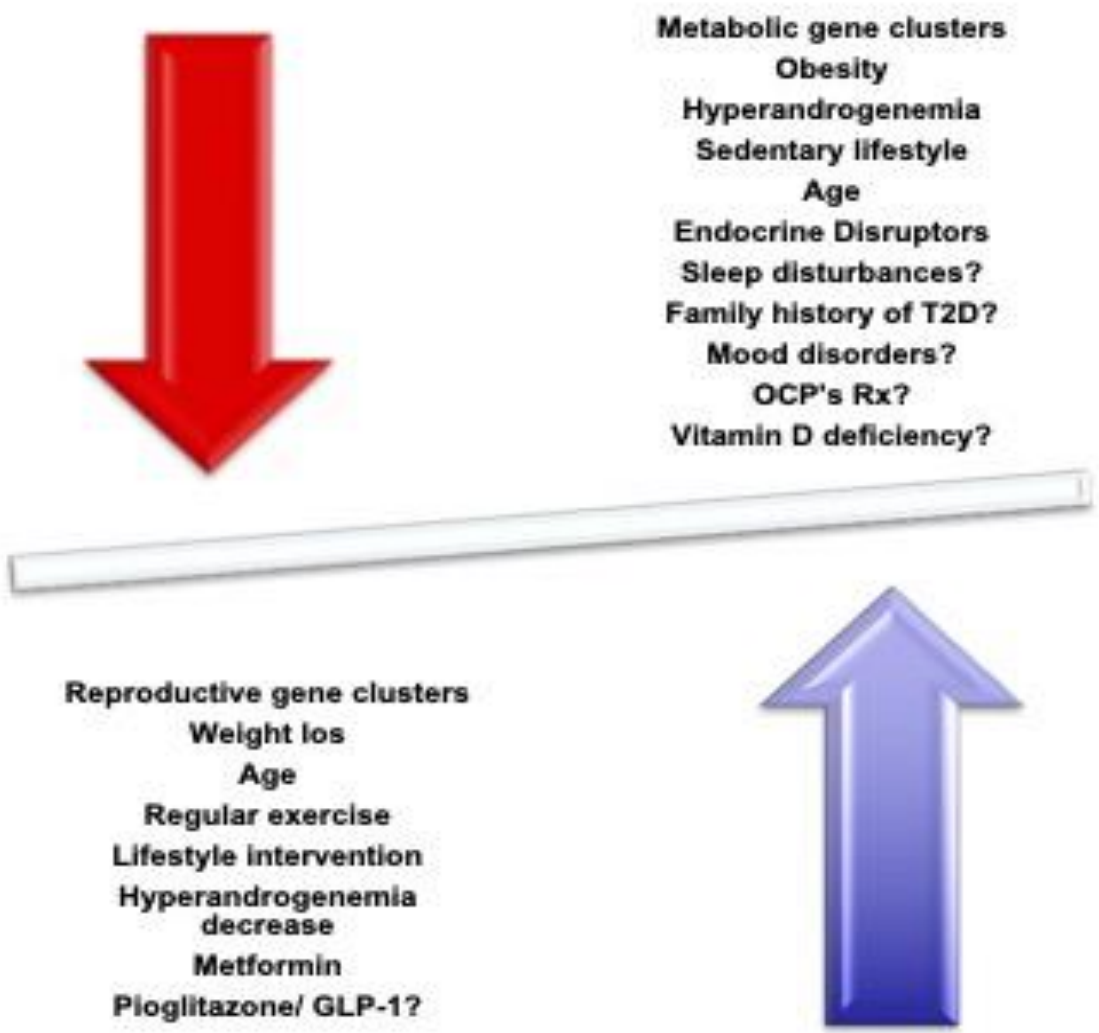
The risk

=> decreased with increasing age

=> remained significantly higher in women with PCOS across all age groups.

Ng, Diabetes Research and Clinical Practice, 2023

Factors associated with T2DM development in women with PCOS



Livadas et al., WJD, 2021

Συμπεράσματα

- **Η Αντίσταση στην ινσουλίνη μεταβάλλεται προϊόντος του χρόνου.**
- **Η IR και η δυσλειτουργία των β-κυττάρων συνυπάρχουν στο ΣΠΩ.**
- **Ο κίνδυνος για ΣΔ εξαρτάται από**
  - **ΣΒ – Τρόπος ζωής- Μορφωτικό επίπεδο**
  - **Γονίδια – Υπερανδρογοναιμία**
- **Δεν υπάρχει ιδανικός τρόπος προσδιορισμού της δυσγλυκαιμίας**
- **Η συχνότητα εμφάνισης ΣΔ2 είναι υψηλότερη στο ΣΠΩ.**
- **Μελλοντικά, ο κίνδυνος ΣΔ2 είναι μειωμένος σε γυναίκες με PCOS κανονικού βάρους και αυξημένος στις παχύσαρκες.** **Πιθανώς, η μείωση των ανδρογόνων που ακολουθείται από μια παράλληλη μείωση του IR εξηγεί αυτή την παρατήρηση**

Ευχαριστίες

- **Anagnostis P**
- Paparodis R
- Bothou C
- Bosdou JK
- Angelopoulos N
- Vryonidou A
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- **Macut D**
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- Robeva R
- Yildiz B

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