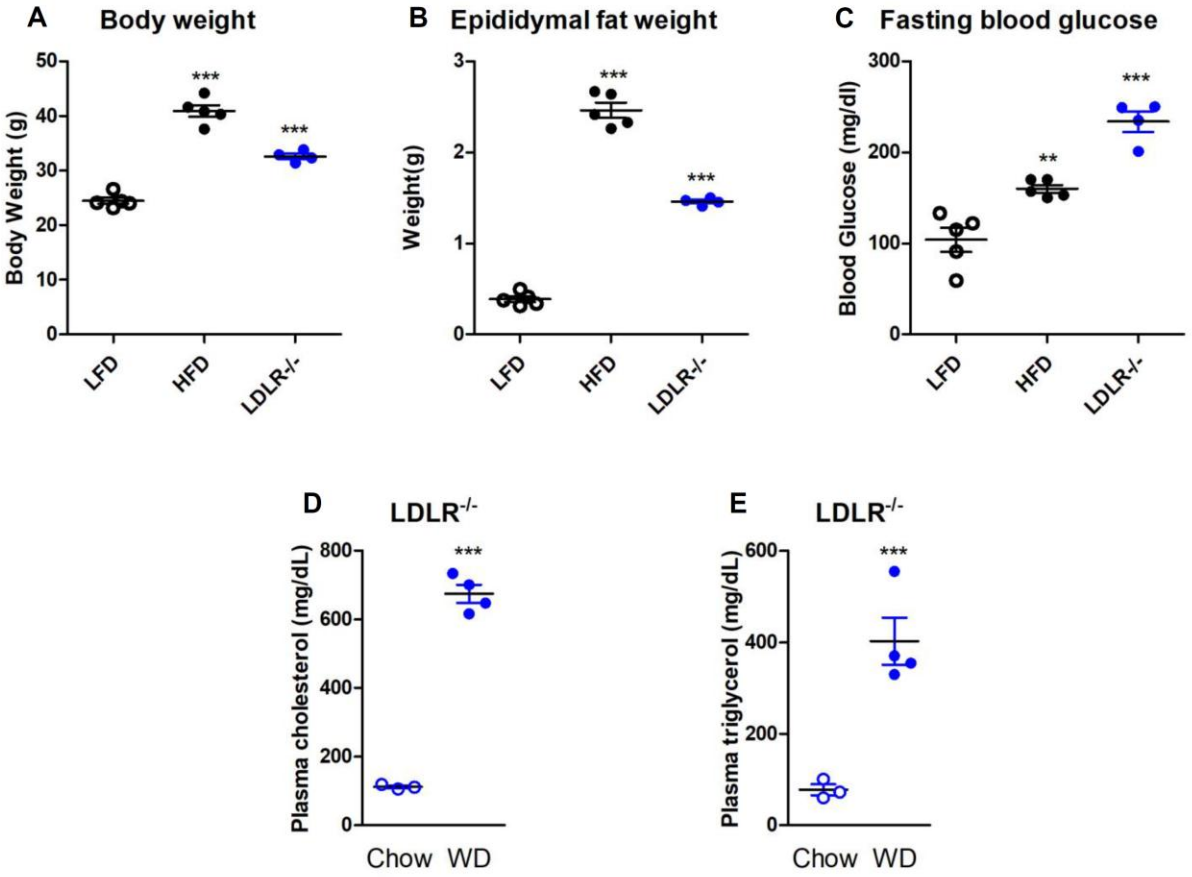
SUPPLEMENTARY DATA

Supplementary Figure 1. Rodent physiology data

The (A) body weight, (B) epididymal fat weight, and (C) and fasting blood glucose of LDLR$^{-/-}$ mice or mice fed a low fat diet (LFD)-fed or high fat diet (HFD). The (D) plasma cholesterol and (E) triglycerol levels of LDLR$^{-/-}$ mice raised on a western diet (WD). (F) Body weight and fed blood glucose levels of ZDF rats, db/db mice and their corresponding controls (SD rat and db/+ mice). All error bars indicate SEM. **P<0.01, ***P<0.001.

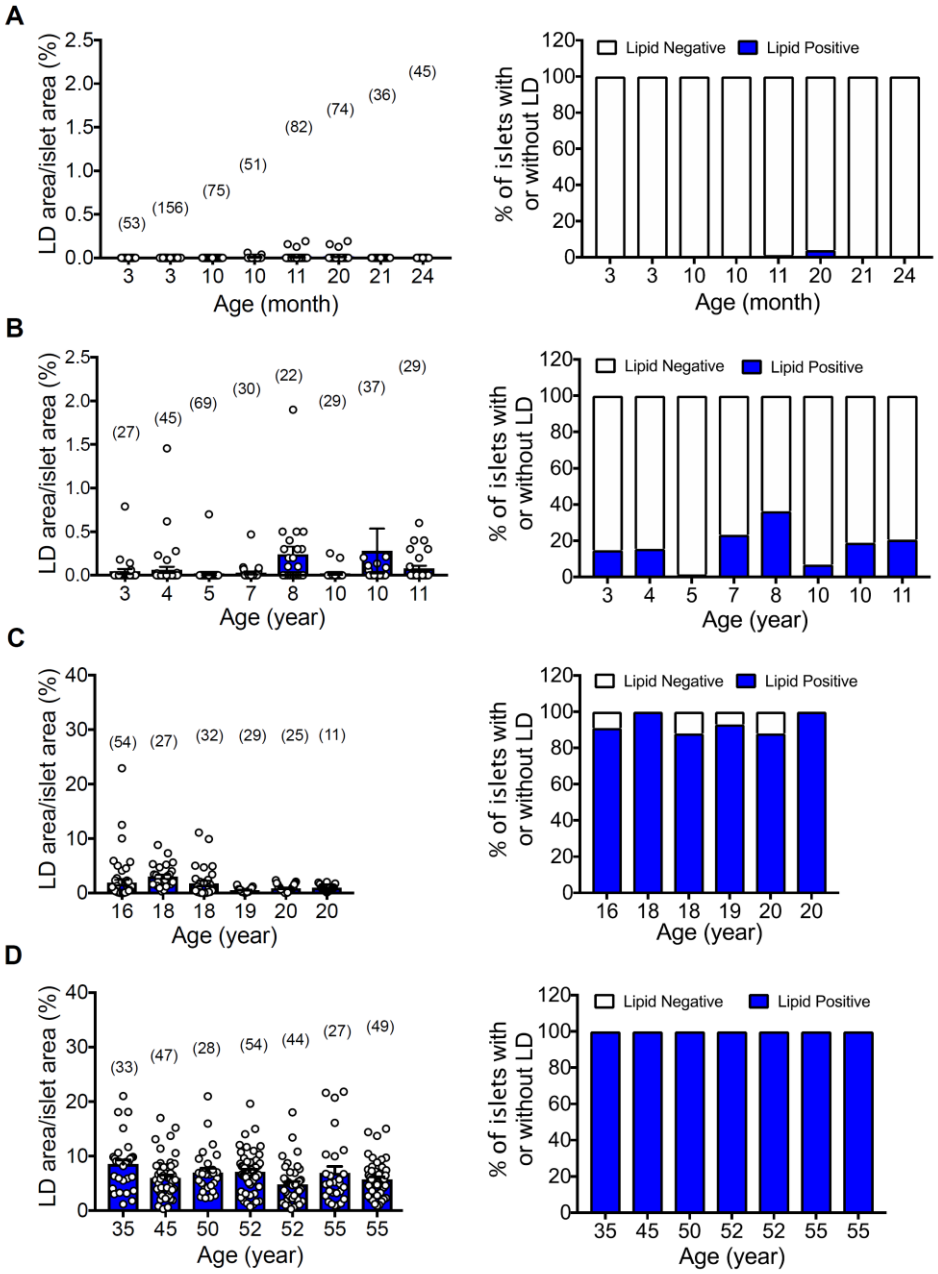


F

Rodent type	Body weight	Fed blood glucose
SD rat (n=2)	275g (average)	110mg/dl (Average)
ZDF rat (n=1)	360g	270mg/dl
db/+ mouse (n=3)	30.7g (Average)	195mg/dl (Average)
db/db mouse (n=3)	49.5g (Average)	377.7mg/dl (Average)

SUPPLEMENTARY DATA

Supplementary Figure 2. Analysis of the change in human islet LD content in respect to age.
The human islet LD level from years (A) 0-2, (B) 3-11, (C) 16-20, and (D) 35-55 years. The number of islets counted per donor are in parenthesis. The results were determined from images represented in Figure 2.

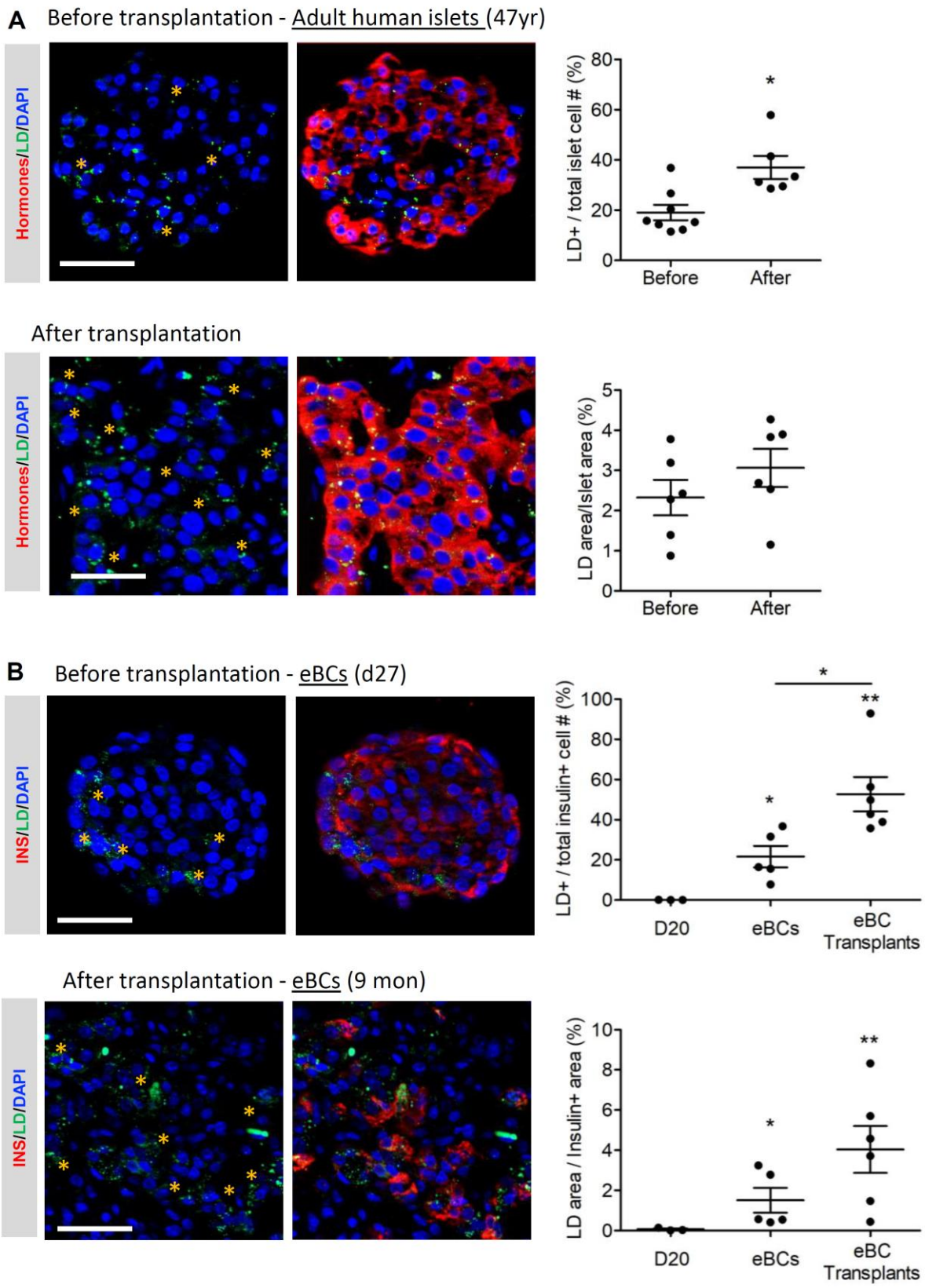


SUPPLEMENTARY DATA

Supplementary Figure 3. The change in LD distribution in pre- and post-transplanted human islets and eBCs.

(A) Representative BODIPY staining images before and after transplantation of islets from a 47 year-old human islet donor. The asterisk (brown) in the left panel depicts the $BODIPY^+$ (green) signal in islet cells, with the $hormone^+$ (red) and $BODIPY^+$ cell signals shown in the right panel. The graphs illustrate that LDs are found in more islet cells after transplantation. There is also a trend towards increased LD^+ area within the islet after transplantation. Quantitation was performed on 8 islets before transplantation and 6 separate 0.1 mm^2 areas after transplantation. (B) Representative $BODIPY^+$ and $insulin^+$ cell images of *in vitro* eBCs and eBC transplants after 9 months in NSG mice. The asterisk depicts the BODIPY+ (green) cell signal. The graphs show the significantly higher number of LD^+ cells in $insulin^+$ cells within the 3- and 9-month transplanted eBCs in relation to *in vitro*-derived D20 $insulin^+$ cells or *in vitro*-derived eBCs. Each dot represents the average reading from an independently derived sample (D20, n=3; eBC, n=5; eBC transplants, n=6). All error bars indicate SEM. *P<0.05, **P<0.01.

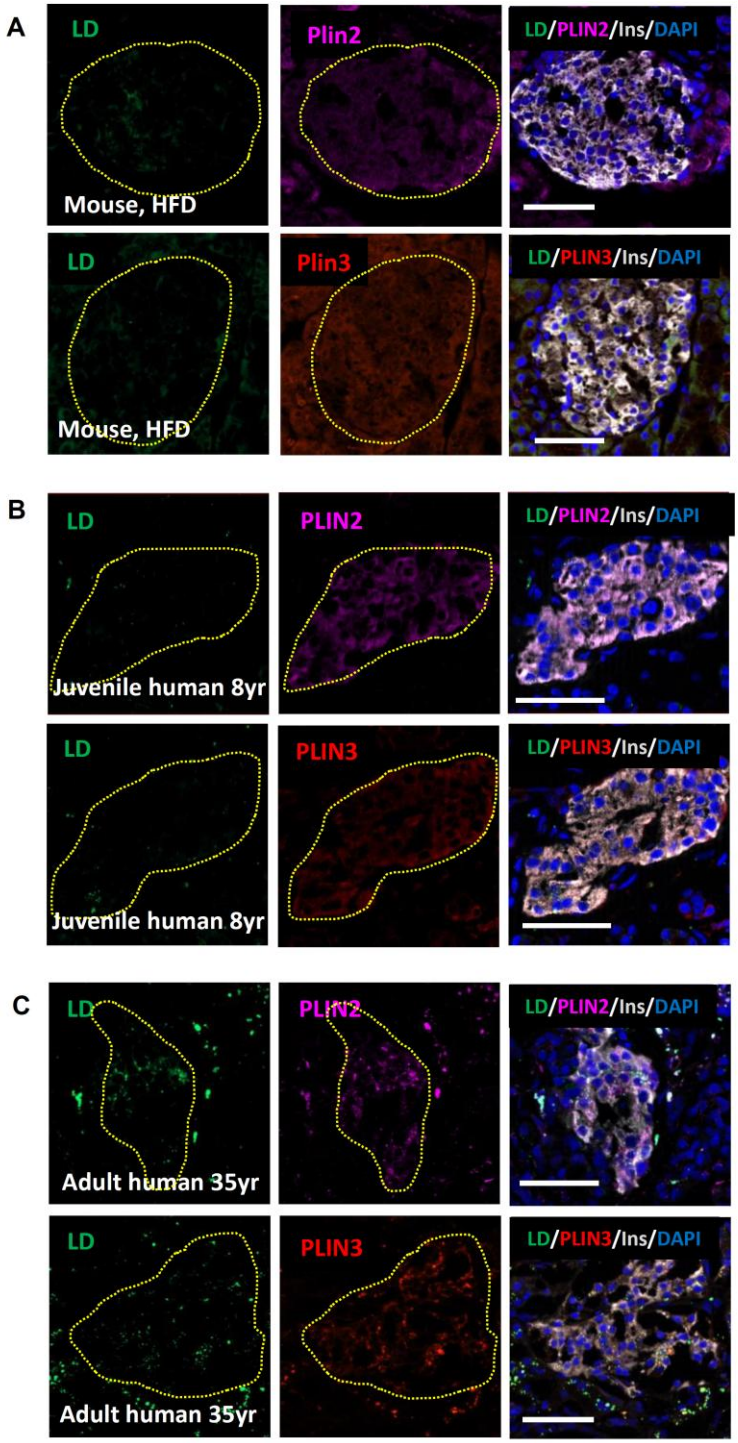
SUPPLEMENTARY DATA



SUPPLEMENTARY DATA

Supplementary Figure 4. PLIN2 and PLIN3 have a weak, diffuse protein staining pattern in mouse and juvenile human islets in comparison to adult humans

Pancreatic images from a (A) HFD-fed mouse, (B) 8 year-old human and (C) 35 year-old human analyzed for LD BODIPY (green), insulin (white), PLIN2 (magenta), PLIN3 (red) and nuclei (DAPI, blue). The yellow dotted lines outline the islet insulin^{+} (white) area.

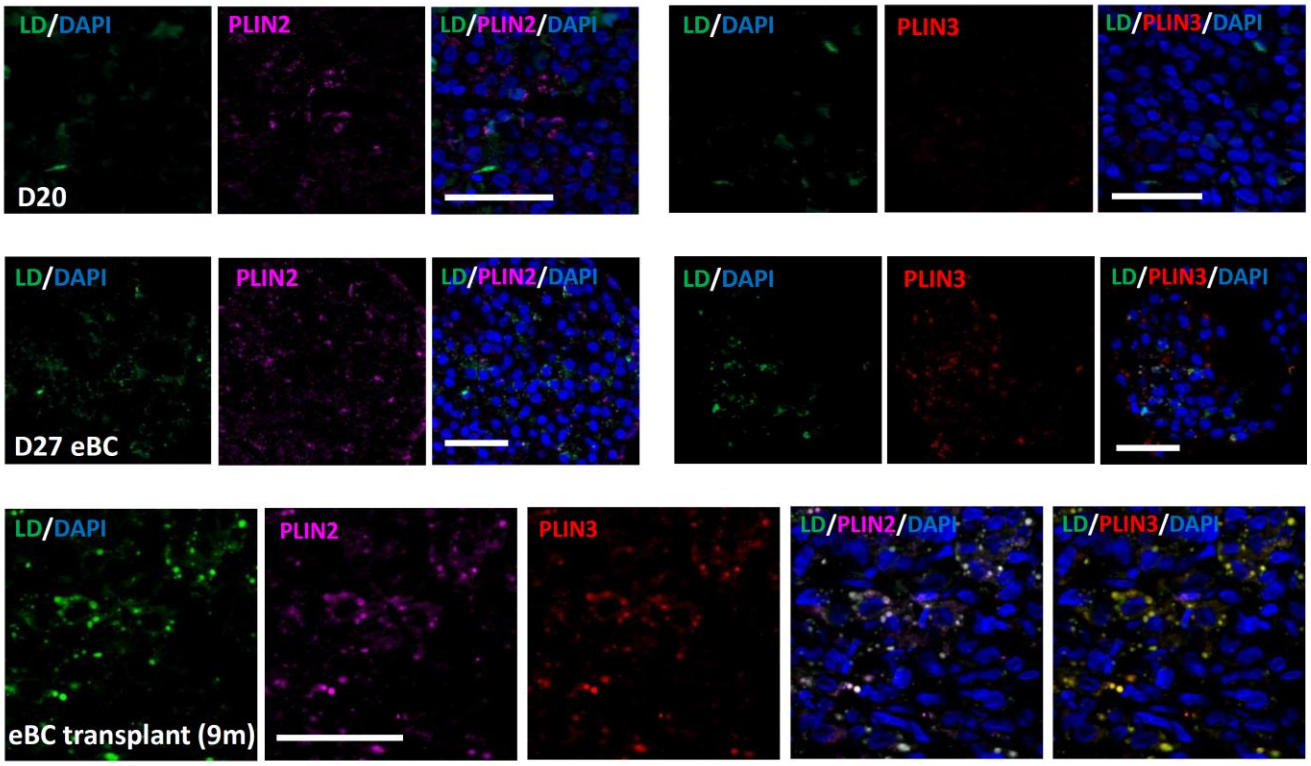


SUPPLEMENTARY DATA

Supplementary Figure 5. LD and PLIN2/3 levels in the D20 immature islet clusters, eBCs, and NSG transplanted eBCs.

(A) Representative immunostaining images of BODIPY (green), PLIN2 (magenta), PLIN3 (red) and nuclei (DAPI, blue) in D20, D27 eBC and a 9-month (m) eBC transplant. Scale bar = 50 μm. (B) Summary of the BODIPY, PLIN2 and PLIN3 levels data collected on the D20, eBCs and eBC transplant samples by staining. -, very low level to undetectable; +, low level, ++, intermediate level; +++, high level.

A



B

Time line	Bodipy level	PLIN2 level	PLIN3 level
In vitro-D20	-	+	-
In vitro-D24 (eBCs)	+	+	+
In vitro-D27 (eBCs)	+	+	+
In vitro-D28 (eBCs)	++	+	+
In vivo-3m post Tx	++	++	++
In vivo-9m post Tx	+++	++	++

SUPPLEMENTARY DATA

Supplementary Table 1. Detailed human donor information and LD levels (adult > 26Y)

Disease condition	Age	Gender	BMI	Assay used	Used in figure	Islet LD%	Acinar LD%	HbA1C
Healthy	35yr	M	26.8	LD quantification	2B-C, 5, 7B-E Supplemental 2D, 5C	8.5	6.0	NA
Healthy	45yr	F	29.7	LD quantification	2B-C, 7B-E, Supplemental 2D	5.9	7.3	NA
Healthy	50yr	M	NA	LD quantification	2A-C, 7B-E, Supplemental 2D	7.0	5.5	NA
Healthy	52yr	M	29.2	LD quantification	2B-C, 7B-E, Supplemental 2D	5.7	2.6	NA
Healthy	52yr	M	28	LD quantification	2B-C, 7B-E, Supplemental 2D	4.8	1.4	NA
Healthy	55yr	M	35.6	LD quantification	2B-C, 7B-E, Supplemental 2D	7.1	3.2	NA
Healthy	55yr	F	24.2	LD quantification	1D, 2B-C, 7A-E, Supplemental 2D	7.6	6.2	NA
Newly diagnosed T2D	40yr	F	43.1	LD quantification	7B-E	10.5	0.9	8.2%
Newly diagnosed T2D	42yr	M	42	LD quantification	7B-E	5.7	1.1	8.1%
T2D for 5Y	37yr	M	49.8	LD quantification	7B-E	2.6	0.6	6.9%
T2D for 1Y	43yr	M	36.1	LD quantification	7B-E	8.6	3.1	7.0%
T2D for 3Y	47yr	M	31.3	LD quantification	7B-E	3.5	0.2	NA
T2D for 3Y	49yr	F	33.8	LD quantification	7B-E	6.2	0.9	8.3%
T2D for 4Y	50yr	M	32.9	LD quantification	7A-E	3.9	0.9	11.2%
T2D for 10Y	59yr	F	27.5	LD quantification	7B-E	17.0	6.7	6.2%
T2D for 1Y	60yr	M	38.3	LD quantification	7B-E	13.0	1.7	7.2%
T2D for 5Y	64yr	M	33.2	LD quantification	7B-F	8.4	2.3	NA
T2D for 3Y	66yr	F	33	LD quantification	7B-E	5.5	0.8	NA
Healthy	67yr	F	NA	EM	1A-C	NA	NA	NA

SUPPLEMENTARY DATA

Supplementary Table 2. LD analysis - Healthy human donor information (3 m – 20 years)

Age	Gender	BMI	Assay used	Used in figure
3m	M	16.8	LD quantification	2B-C, Supplemental 2A
3m	M	17	LD quantification	2B-C, Supplemental 2A
10m	F	15.4	LD quantification	2B-C, Supplemental 2A
10m	F	23.1	LD quantification	2B-C, Supplemental 2A
11m	M	18.4	LD quantification	2A-C, Supplemental 2A
20m	F	23.4	LD quantification	2B-C, Supplemental 2A
21m	M	18.8	LD quantification	2B-C, Supplemental 2A
24m	F	17.4	LD quantification, EM	1A-C, 2B-C, Supplemental 2A
3yr	F	12.9	LD quantification, EM	1B-C, 2B-C, Supplemental 2B
4yr	M	19.6	LD quantification, EM	1B-C, 2B-C, Supplemental 2B
5yr	M	17.8	LD quantification	2B-C, Supplemental 2B
7yr	M	26.7	LD quantification	2A-C, Supplemental 2B
8yr	F	16.1	LD quantification, EM	1A-C, 2B-C, Supplemental 2B, 5B
10yr	M	19.9	LD quantification	2B-C, Supplemental 2B
10yr	F	18.6	LD quantification, EM	1A-C, 2B-C, Supplemental 2B
11yr	M	18.3	LD quantification	1B-C, 2B-C, Supplemental 2B
16yr	M	23.2	LD quantification	2B-C, Supplemental 2C
18yr	M	31.4	LD quantification	2B-C, Supplemental 2C
18yr	M	25.1	LD quantification	2B-C, Supplemental 2C
19yr	M	21.2	LD quantification, EM	1A-C, 2A-C, Supplemental 2C
20yr	M	27.8	LD quantification	2B-C, Supplemental 2C

SUPPLEMENTARY DATA

Supplementary Table 3. qPCR analysis - human donor information

Disease condition	Age	Gender	BMI	Assay used
Healthy	14m	F	NA	6A, D
Healthy	20m	M	NA	6A, D
Healthy	3yr	NA	NA	6A, D
Healthy	4yr	F	NA	6A, D
Healthy	5yr	M	NA	6A, D
Healthy	9yr	NA	NA	6A, D
Healthy	35yr	M	28.5	6B, D, G
Healthy	37yr	M	27.6	6B, D, G
Healthy	39yr	M	26.5	6B, D, G
Healthy	43yr	M	24	6B, D, F, G
Healthy	44yr	F	23.8	6B, D, F, G
Healthy	48yr	F	29.2	6B, D, F, G
Healthy	53yr	F	28.8	6B, D, F, G
Healthy	59yr	F	22	6B, D, F, G
Healthy	68yr	M	24.9	6B, D, F, G
T2D	47yr	M	31.3	6E, F
T2D	49yr	F	33.8	6E, F
T2D	51yr	F	31.1	6E, F
T2D	59yr	M	NA	6E, F
T2D	60yr	F	38.3	6E, F
T2D	61yr	M	42.1	6E, F

SUPPLEMENTARY DATA

Supplementary Table 4. Transplants LD analysis - human donor information

Disease condition	Age	Gender	BMI	Assay used	Used in figure
Healthy	2mo	NA	NA	Transplantation	3B-C
Healthy	10mo	NA	NA	Transplantation	3B-C
Healthy	6yr	NA	NA	Transplantation	3B-C
Healthy	11yr	M	17.8	Transplantation	3B-C
Healthy	37yr	M	NA	Transplantation	3B-C
Healthy	43yr	M	29.6	Transplantation	3B-C
Healthy	45yr	M	29.3	Transplantation	3B-C
Healthy	48yr	F	29.2	Transplantation	3B-C
Healthy	47yr	M	36.1	Transplantation	Supplemental 3

SUPPLEMENTARY DATA

Checklist for Reporting Human Islet Preparations Used in Research

Adapted from Hart NJ, Powers AC (2018) Progress, challenges, and suggestions for using human islets to understand islet biology and human diabetes. Diabetologia https://doi.org/10.1007/s00125-018-4772-2.

Manuscript DOI: https://doi.org/10.2337/ DB19-0281.R1	
Title: Lipid droplet accumulation in human pancreatic islets is dependent upon both donor age and health	
Author list: Xin Tong, Chunhua Dai, John T. Walker, Gopika G. Nair, Arion Kennedy, Rotonya M. Carr, Matthias Hebrok, Alvin C. Powers and Roland Stein	
Corresponding author: Roland Stein	**Email address: roland.stein@vanderbilt.edu**

Juvenile

Islet preparation	1	2	3	4	5	6	7	8	9	10
MANDATORY INFORMATION										
Unique identifier	N/A	N/A	N/A	N/A	N/A	N/A	ACKE380	N/A	N/A	ADEY348
Donor age (years)	1.2 (14m)	1.7 (20m)	3	4	5	9	2m	10m	6	11
Donor sex (M/F)	F	M	N/A	F	M	N/A	N/A	N/A	N/A	M
Donor BMI (kg/m^2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.8

SUPPLEMENTARY DATA

Donor HbA_{1c} or other measure of blood glucose control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Origin/source of islets[b]	IIDP	AHN	IIDP	IIDP	AHN	AHN	AHN	AHN	AHN	AHN
Islet isolation centre	U Wisconsin	AHN	U Wisconsin	U Wisconsin	AHN	AHN	AHN	AHN	AHN	AHN
Donor history of diabetes? Yes/No	No	No	No	No	No	No	No	No	No	No

RECOMMENDED INFORMATION										
Donor cause of death	N/A	N/A	N/A	N/A	N/A	CVA/ stroke	N/A	N/A	N/A	N/A
Warm ischaemia time (h)	N/A	N/A	N/A	N/A	N/A	11	N/A	N/A	N/A	N/A
Cold ischaemia time (h)	N/A	N/A	N/A	18	N/A	11	N/A	N/A	N/A	N/A
Estimated purity (%)	85	N/A	N/A	87	N/A	65	N/A	N/A	N/A	N/A
Estimated viability (%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total culture time (h)[d]	24	N/A	<24	N/A	<24	36	N/A	N/A	N/A	N/A
Glucose-stimulated insulin secretion or other functional measurement[e]	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion *	yes	No	yes	No
Handpicked to purity? Yes/No	yes	yes	yes	yes	yes	yes	No	No	No	No

SUPPLEMENTARY DATA

Additional notes										

Healthy adults-1

Islet preparation	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
MANDATORY INFORMATION										
Unique identifier	ADBC220	ADIP333	CCM433A	AAKS193	ACCZ042	AAK4206	ABAI077	AEAT060	ADCK302	SAMN11791244
Donor age (years)	35	37	39	43	44	48	53	59	68	47
Donor sex (M/F)	M	M	M	M	F	F	F	F	M	M
Donor BMI (kg/m^2)	28.5	27.6	26.5	24	23.8	29.2	25.4	22	24.9	36.1
Donor HbA_{1c} or other measure of blood glucose control	5.3	N/A	N/A	N/A	N/A	6.4	N/A	5.2	4.8	5.7
Origin/source of islets[b]	IIDP	IIDP	IIDP	IIDP	IIDP	IIDP	IIDP	IIDP	IIDP	IIDP
Islet isolation centre	U Penn	U. Wisconsin	S California	U Miami	U Penn	U. Wisconsin	U Penn	U. Wisconsin	U. Illinois	S California
Donor history of diabetes? Yes/No	No	No	No	No	No	No	No	No	No	No
RECOMMENDED INFORMATION										

SUPPLEMENTARY DATA

Donor cause of death	Head trauma	CVA/ stroke	CVA/ stroke	CVA/ stroke	CVA/ stroke	CVA/ stroke	N/A	CVA/ stroke	Head trauma	CVA
Warm ischaemia time (h)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.3
Cold ischaemia time (h)	6.5	11.25	N/A	12.6	6.2	4	6.5	6.5	7	6.4
Estimated purity (%)	95	90	83	90	95	85	97	95	95	95
Estimated viability (%)	95	95	97	90	95	94	97	96	98	96
Total culture time (h)[d]	65	48	48	66	46	16	19	36	48	29
Glucose-stimulated insulin secretion or other functional measurement[e]	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*
Handpicked to purity? Yes/No	yes	yes	yes	yes	yes	yes	yes	yes	yes	No
Additional notes										

Healthy adults-2

Islet preparation	**21**	**22**	**23**	**24**
MANDATORY INFORMATION				

SUPPLEMENTARY DATA

Unique identifier	ADIP333	AADP290	AFEA331	AAK4206
Donor age (years)	37	43	45	48
Donor sex (M/F)	M	M	M	F
Donor BMI (kg/m^2)	N/A	29.6	29.3	29.2
Donor HbA_{1c} or other measure of blood glucose control	N/A	N/A	N/A	6.4
Origin/source of islets[b]	IIDP	IIDP	IIDP	IIDP
Islet isolation centre	U. Wisconsin	U Penn	S California	U. Wisconsin
Donor history of diabetes? Yes/No	No	No	No	No
RECOMMENDED INFORMATION				
Donor cause of death	N/A	Head trauma	N/A	CVA
Warm ischaemia time (h)	N/A	N/A	N/A	N/A
Cold ischaemia time (h)	N/A	5.8	N/A	4
Estimated purity (%)	N/A	90	95	90
Estimated viability (%)	N/A	91	95	95

SUPPLEMENTARY DATA

Total culture time (h)[d]	N/A	16	N/A	16
Glucose-stimulated insulin secretion or other functional measurement[e]	yes	yes	yes	yes
Handpicked to purity? Yes/No	No	No	No	No
Additional notes				

T2D adults

Islet preparation	**25**	**26**	**27**	**28**	**29**	**30**
MANDATORY INFORMATION						
Unique identifier	ABIC495	ABHQ115	ADDA138	ADBI307	ADLE098	ABDG032
Donor age (years)	47	49	51	59	60	61
Donor sex (M/F)	M	F	M	M	M	M
Donor BMI (kg/m^2)	31.3	33.8	31.1	N/A	38.3	42.1
Donor HbA_{1c} or other measure of blood glucose control	N/A	N/A	N/A	N/A	7.2	N/A

SUPPLEMENTARY DATA

Origin/source of islets[b]	AHN	AHN	AHN	AHN	AHN	IIDP
Islet isolation centre	AHN	AHN	AHN	AHN	AHN	Sharp/Lacy
Donor history of diabetes? Yes/No	Yes	Yes	Yes	Yes	Yes	Yes
If Yes, complete the next two lines if this information is available						
Diabetes duration (years)	3	3	3	10	0-5	8
Glucose-lowering therapy at time of death[c]	N/A	N/A	N/A	N/A	N/A	N/A
RECOMMENDED INFORMATION						
Donor cause of death	CVA/stroke	CVA/stroke	CVA/stroke	CVA/stroke	Head trauma	Head trauma
Warm ischaemia time (h)	N/A	N/A	N/A	N/A	N/A	N/A
Cold ischaemia time (h)	N/A	N/A	N/A	15.6	14	12.9
Estimated purity (%)	80	60	55	70	70	75
Estimated viability (%)	95	N/A	N/A	85	90	90
Total culture time (h)[d]	27	<24	22	36	21	<24
Glucose-stimulated insulin secretion or other functional measurement[e]	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*	Perifusion*

SUPPLEMENTARY DATA

Handpicked to purity? Yes/No	yes	yes	yes	yes	yes	yes
Additional notes						

*Perifusion was performed to determine basic islet secretory function. All healthy donor islets showed good response indicating high quality isolation and sample preparation; Islets from T2D donors showed different degrees of abnormality. Detailed information is available upon reasonable request.

[a]If you have used more than eight islet preparations, please complete additional forms as necessary

[b]For example, IIDP, ECIT, Alberta IsletCore

[c]Please specify the therapy/therapies

[d]Time of islet culture at the isolation centre, during shipment and at the receiving laboratory

[e]Please specify the test and the results