Irisin 与 运动

职韶阳

2019年7月7日

Irisin与运动

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Serum Irisin Levels Are Regulated by Acute Strenuous Exercise

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Dennis Löffler, Ulrike Müller, Kathrin Scheuermann, Daniela Friebe, Julia Gesing, J
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The Journal of Clinical Endocrinology & Metabolism, Volume 100, Issue 4, 1 April
1289–1299, https://doi.org/10.1210/jc.2014-2932
Published: 01 April 2015 **Article history** ▾

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METABOLISM CLINICAL AND EXPERIMENTAL 64 (2015) 1042–1050

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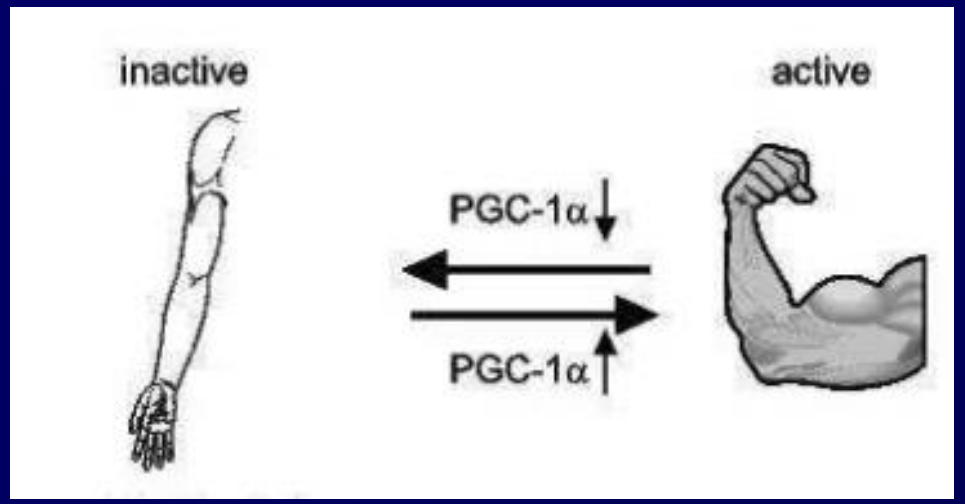
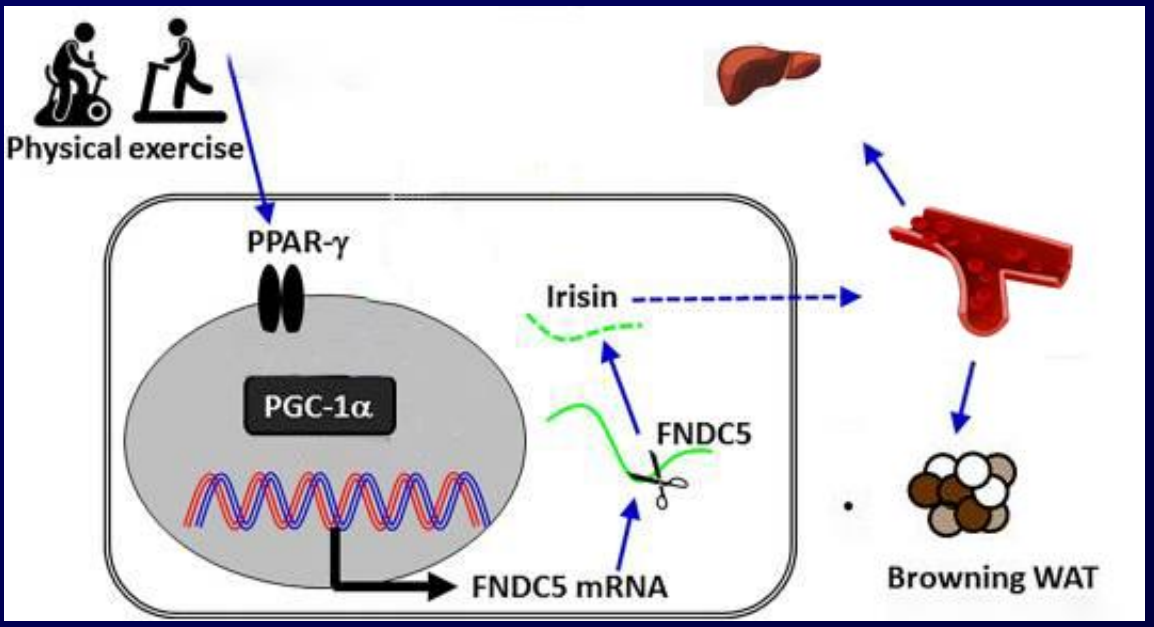
Resistance exercise induces a greater irisin response than endurance exercise

CrossMark

Yoshifumi Tsuchiya [a], *Daisuke Ando* [b,1], *Kaoru Takamatsu* [c], *Kazushige Goto* [a,*]

研究背景





- PGC-1α（过氧化物酶体增殖物激活受体γ共激活因子，是PPARγ的转录共激活因子，二者共同调节产热），主要存在于能量高，线粒体丰富的组织中。
- 在运动期间或刚运动后，产生**PGC-1α**（**3h后PGC-1α表达升高**）刺激肌肉产生**Irisin**
- 作为一种细胞因子，Irisin的氨基末端通过蛋白酶切割后释放进入血液，通过血液作用于身体各个组织、器官。

Serum Irisin Levels Are Regulated by Acute Strenuous Exercise

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急性剧烈运动可调节血清Irisin水平

本文欲从三个方面进行证明：

What can change serum Irisin levels？

diurnal regulation, meals, and glucose

muscle mass and obesity、Age、sex

different exercise schemes on irisin levels in children and young adults.

What can change serum Irisin levels?

diurnal regulation, meals, and glucose

muscle mass and obesity、Age、sex

different exercise schemes on irisin levels in children and young adults.

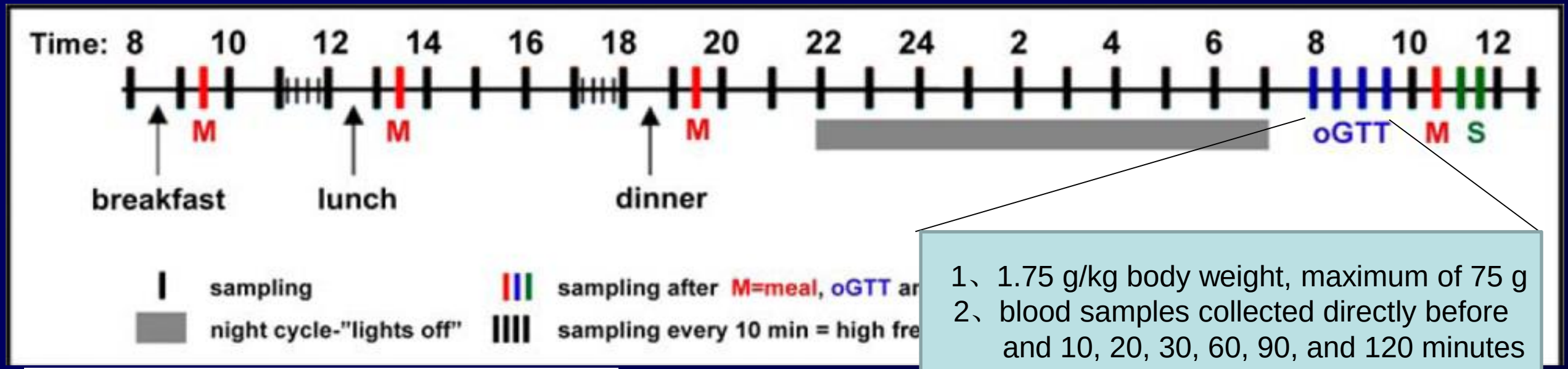
Table 1. Characteristics of the 4 Different Intervention Cohorts*

	Sex (M/F)	Age, y	BMI/BMI SDS
a) Leipzig Atherobesity Childhood cohort			
Lean	20/22	14.5 ± 2.73 (9.65 to 21.17)	−0.32 ± 0.86 (−1.69 to 1.22)
OW + obese	26/37	14.0 ± 2.74 (8.08 to 19.01)	2.59 ± 0.57 (1.48 to 3.96)
b) Diurnal variation in young healthy adults			
Lean	7/7	24.14 ± 2.97 (19.82 to 30.28)	21.29 ± 1.39 (18.67 to 23.57)
Obese	7/7	25.8 ± 5.27 (17.48 to 34.85)	38.23 ± 5.88 (30.95 to 49.67)
c) 6-Week in-house intervention Leipzig Atherobesity Childhood Intervention cohort			
Obese	23/35	12.7 ± 2.28 (7.61 to 16.94)	2.42 ± 0.41 (1.65 to 3.36)
d) Long-term low-grade intervention in school children			
Control	12/17	11.79 ± 0.37 (11.17 to 12.73)	0.02 ± 0.94 (−1.75 to 2.10)
Intervention	20/14	11.8 ± 0.47 (11.02 to 12.84)	0.11 ± 1.11 (−2.39 to 1.99)
Competitive sports	16/9	11.65 ± 0.66 (10.43 to 12.81)	−0.2 ± 0.76 (−1.99 to 1.35)

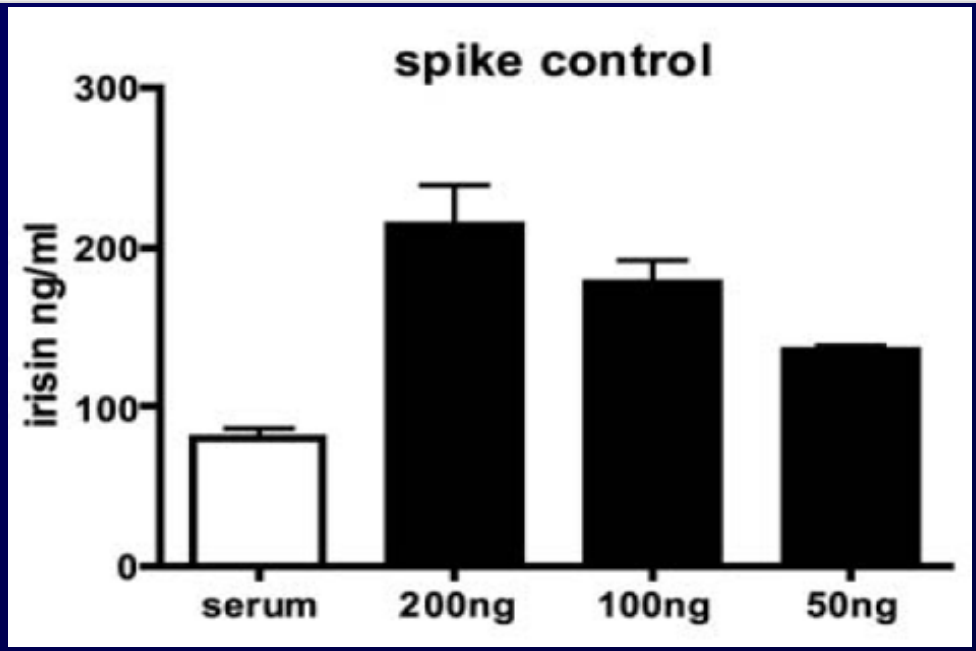
Abbreviations: F, female; M, male; OW, overweight; PH, pubic hair.

* Data are presented as mean ± SEM (range).

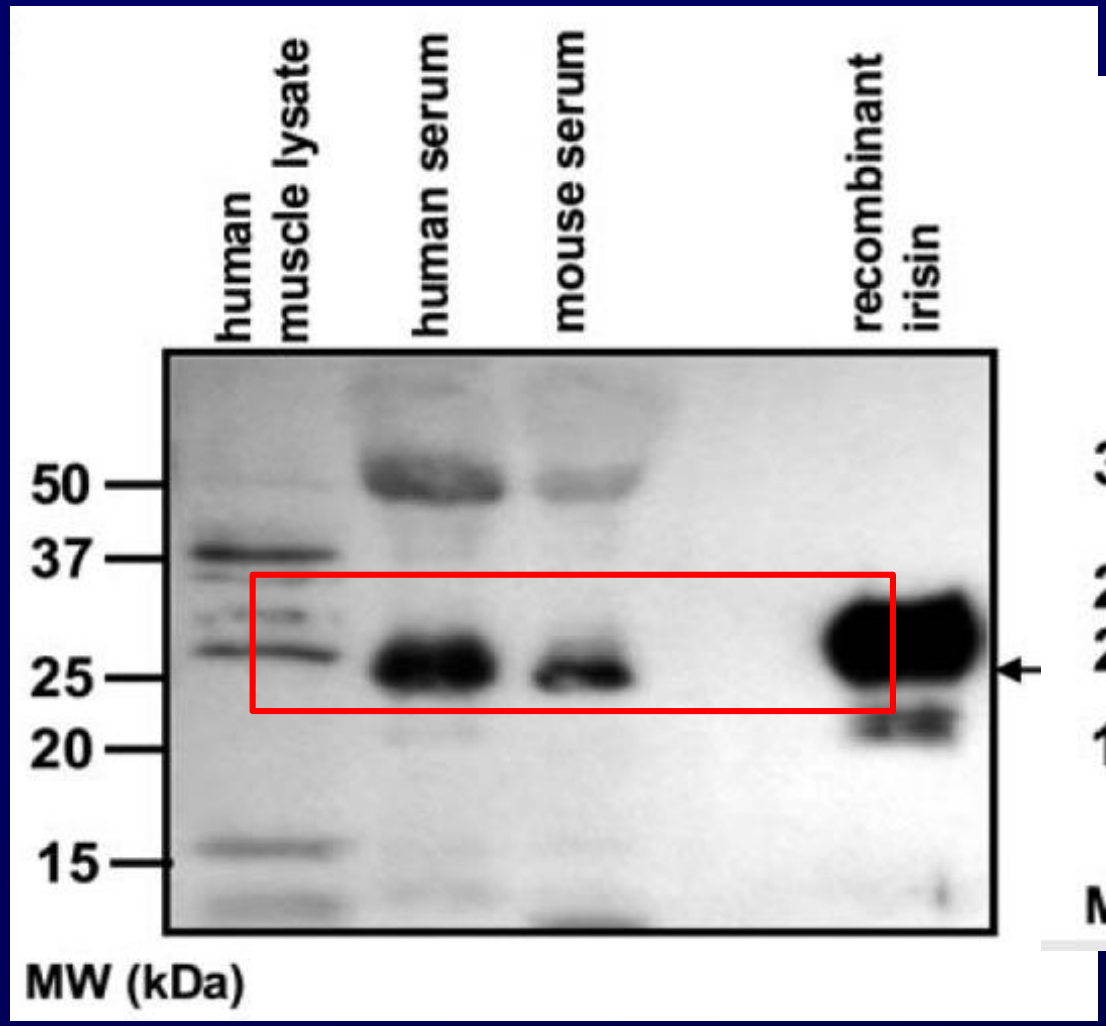
年轻健康成年人血浆Irisin昼夜变化及膳食影响、葡萄糖负荷

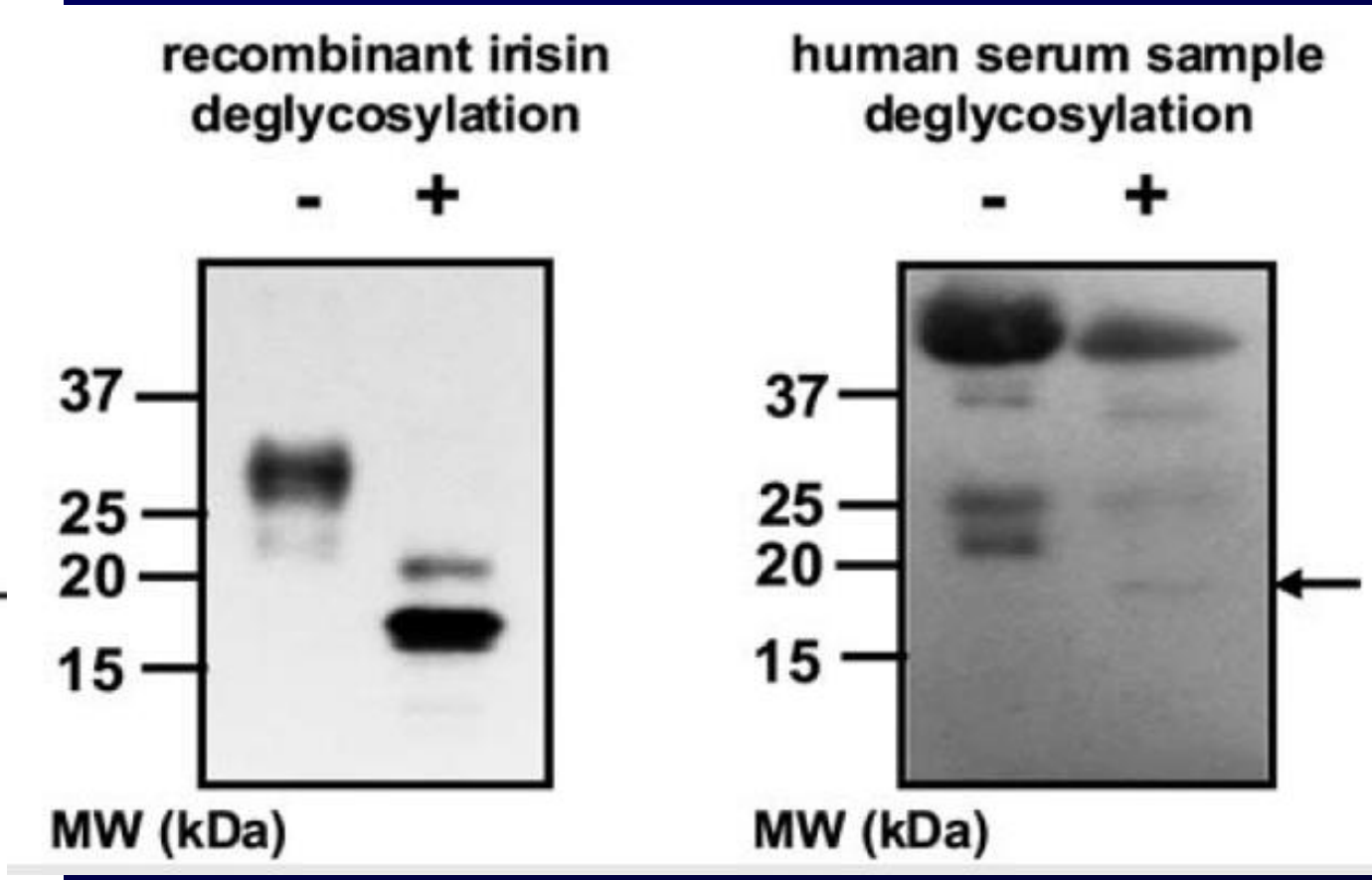


1、1.75 g/kg body weight, maximum of 75 g
2、blood samples collected directly before and 10, 20, 30, 60, 90, and 120 minutes

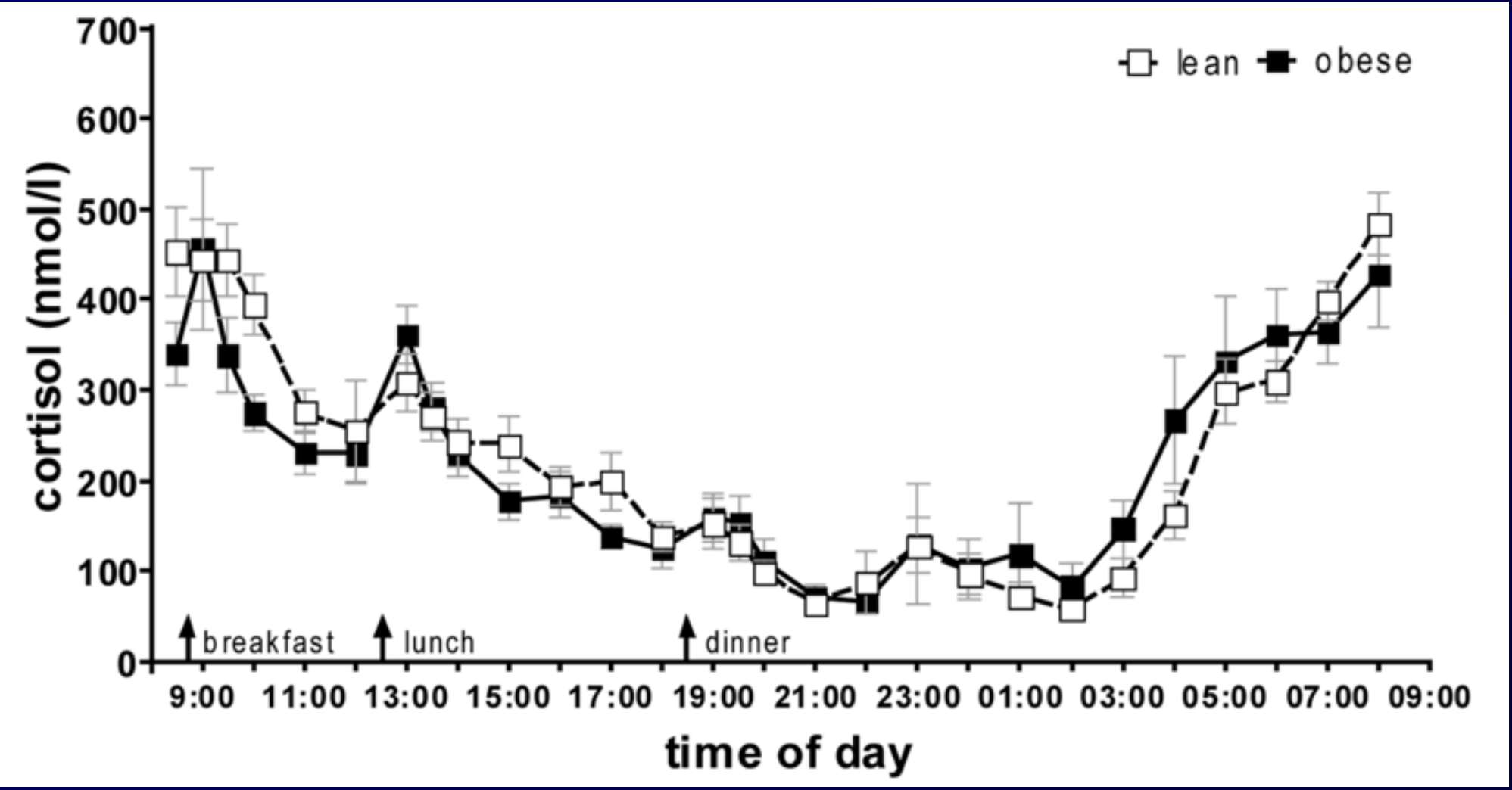


1、Healthy adults aged 18 to 35 years
2、Meals of standardized compositions at defined times (8:30 AM, 12:30 PM, 6:30 PM)
3、subsequently continued with hourly samples for 24 hours
4、reading or watching videos



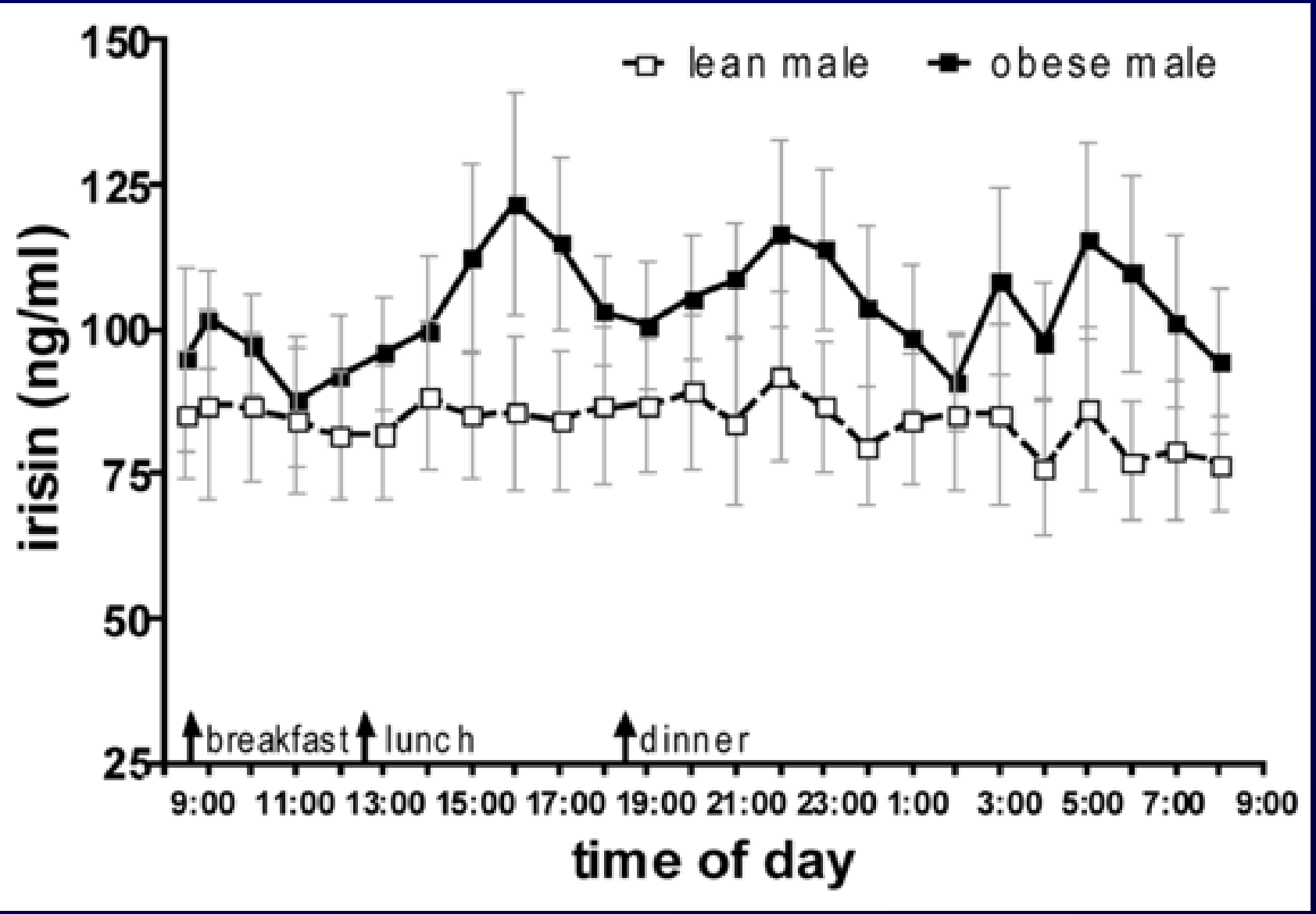


所有样品中都检测到了25kDa的条带，但是在人肌肉裂解物、人血清、鼠血清中在不同分子量大小处有杂带出现，可能是由于糖基化的原因

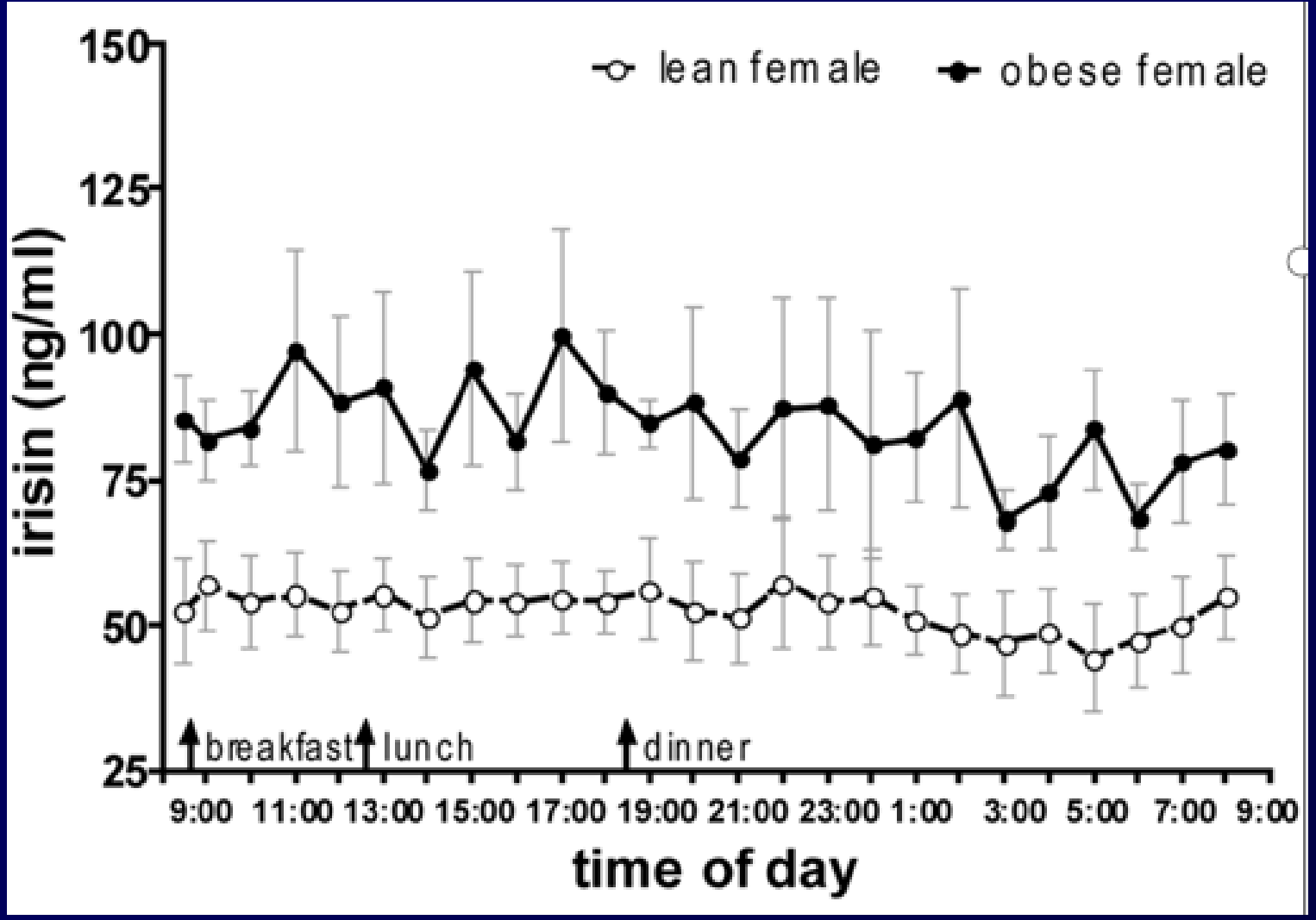


用血清测定皮质醇昼夜变化

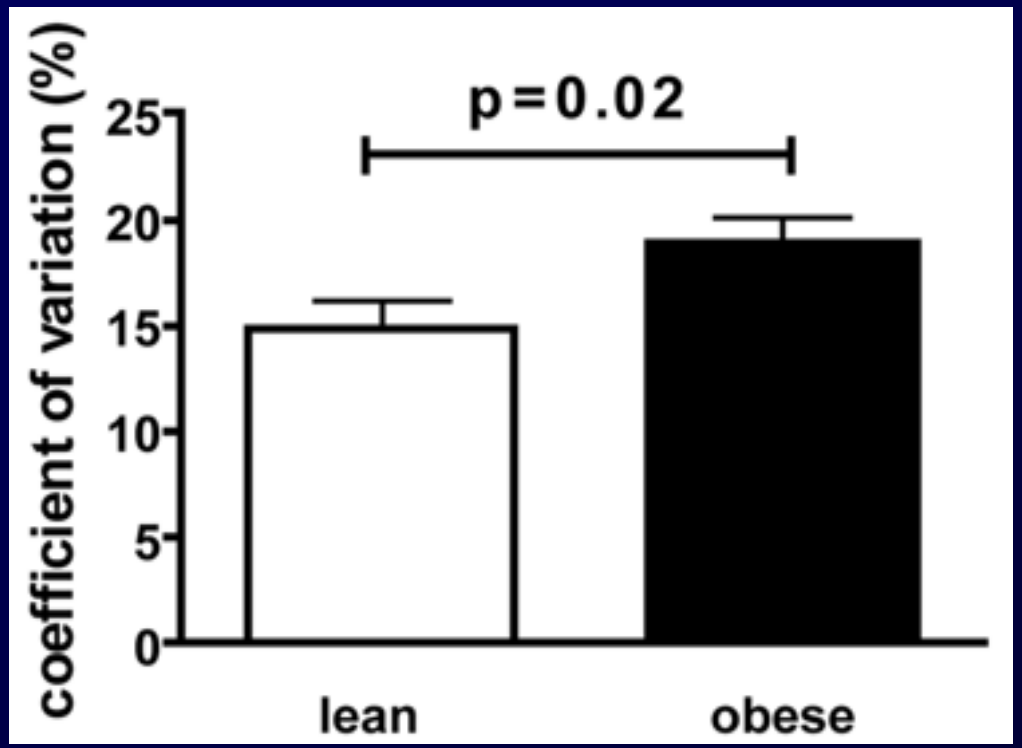
皮质醇具有昼夜节律的特性，其在8点左右为达到峰值，逐渐下降后上升



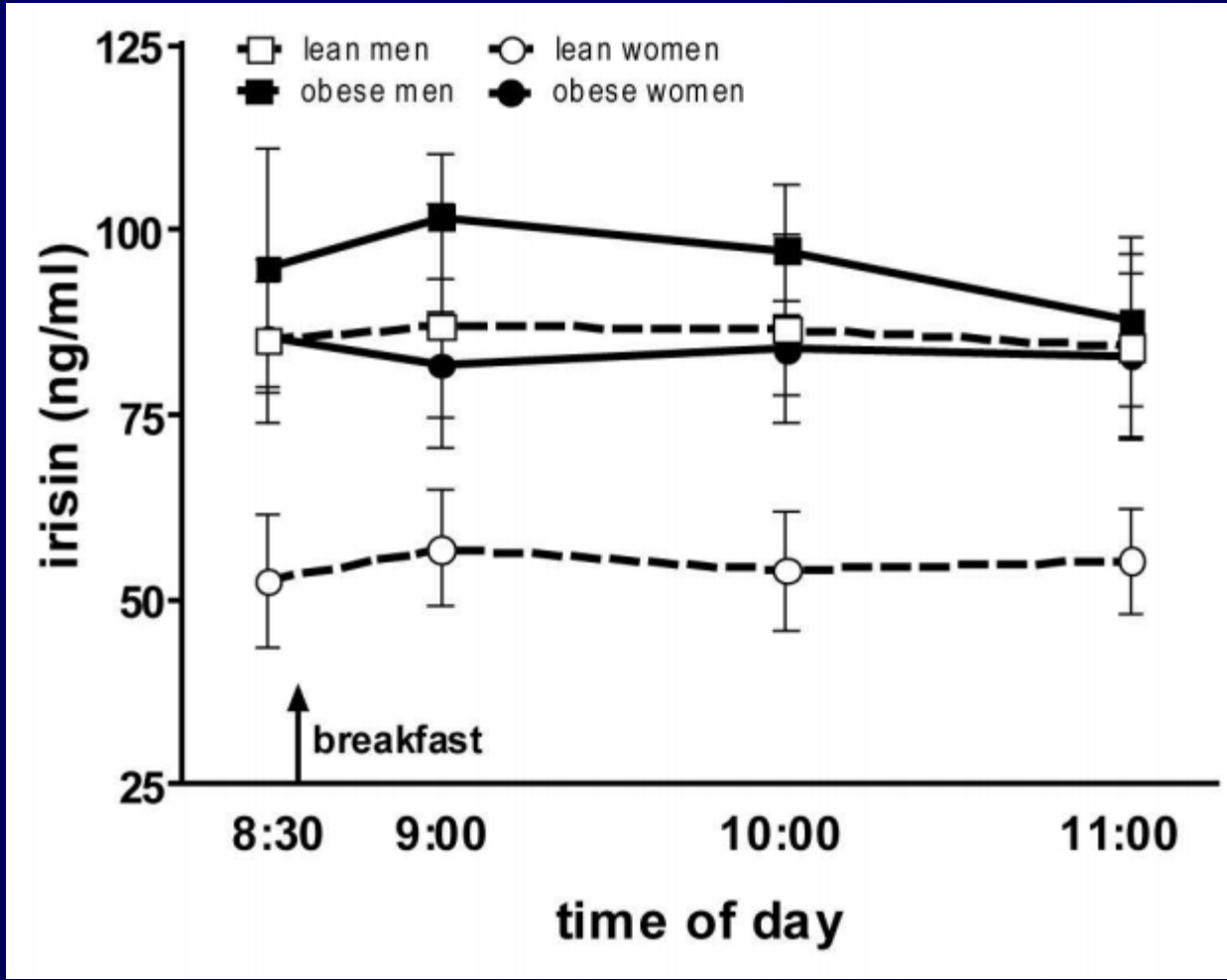
胖、瘦男性血清中Irisin的含量

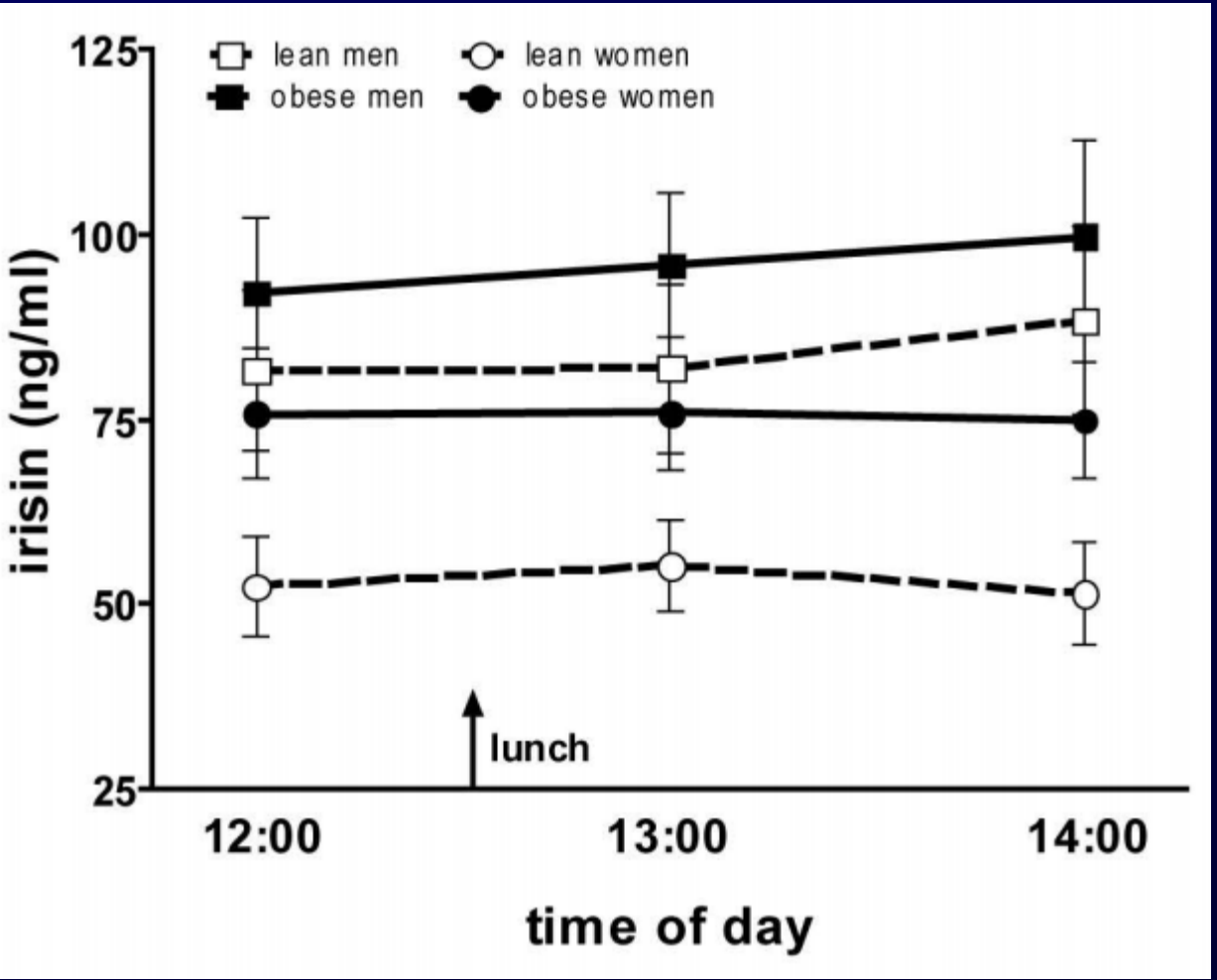


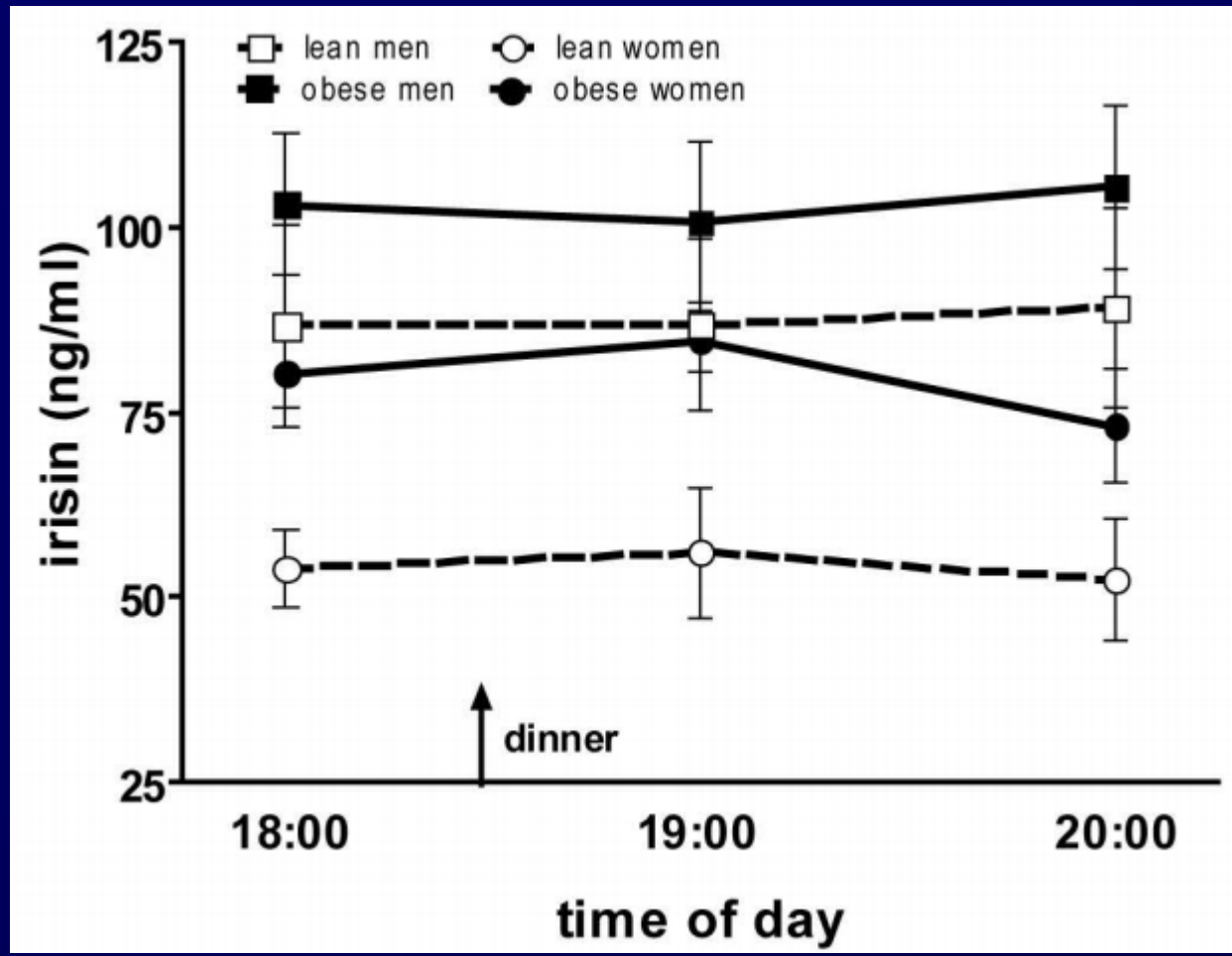
胖、瘦女性血清中Irisin的含量

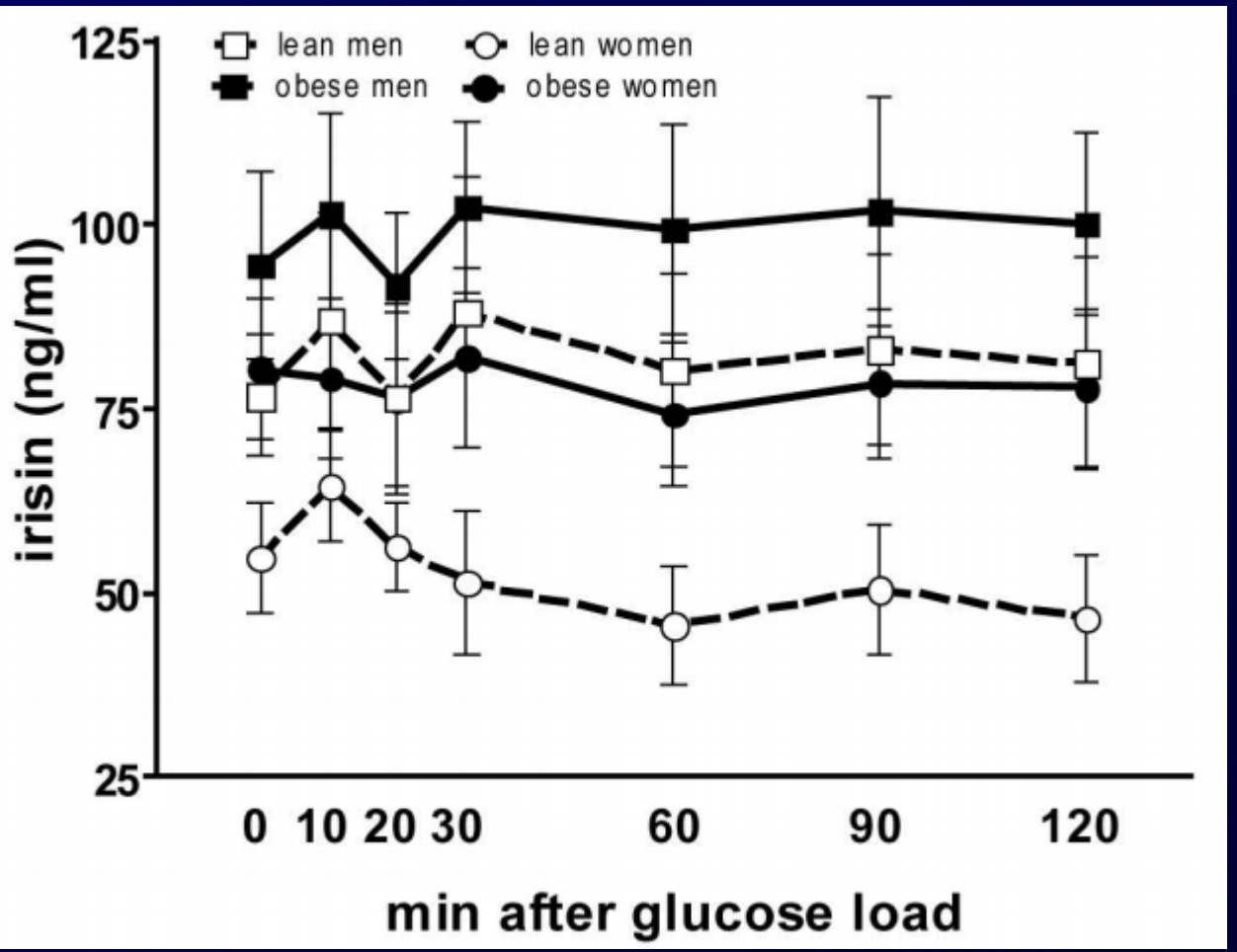


检测胖、瘦人群血清Irisin的变异系数


lean men
lean women
obese men
obese women
125
100
75
50
25
irisin (ng/ml)
breakfast
8:30
9:00
10:00
11:00
time of day


lean men
lean women
obese men
obese women
125
100
75
50
25
irisin (ng/ml)
lunch
12:00
13:00
14:00
time of day





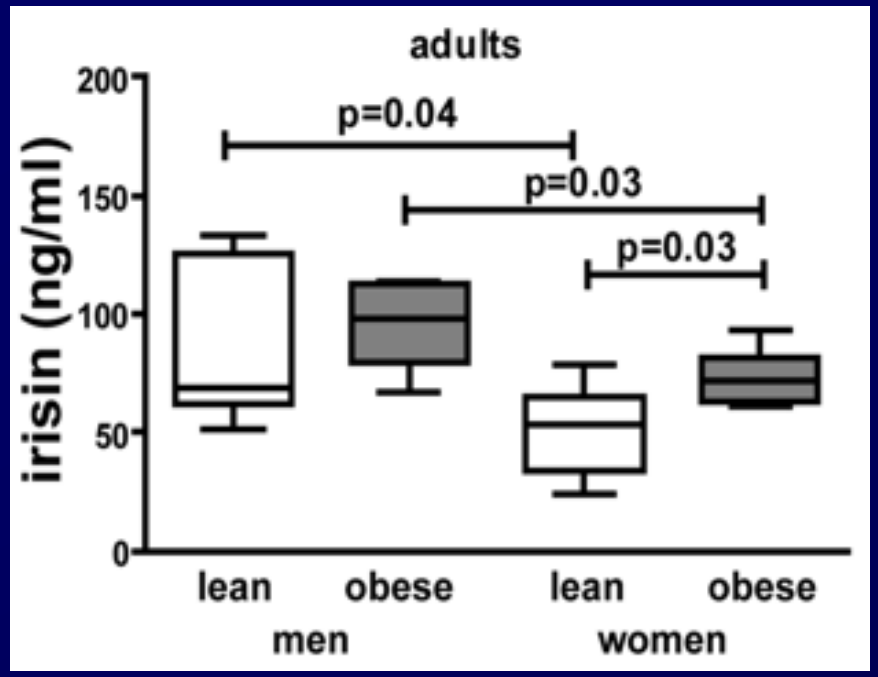
Irisin没有昼夜变化，不受食物摄入的影响，在肥胖人群Irisin具有更高的可变性。

What can change serum Irisin levels?

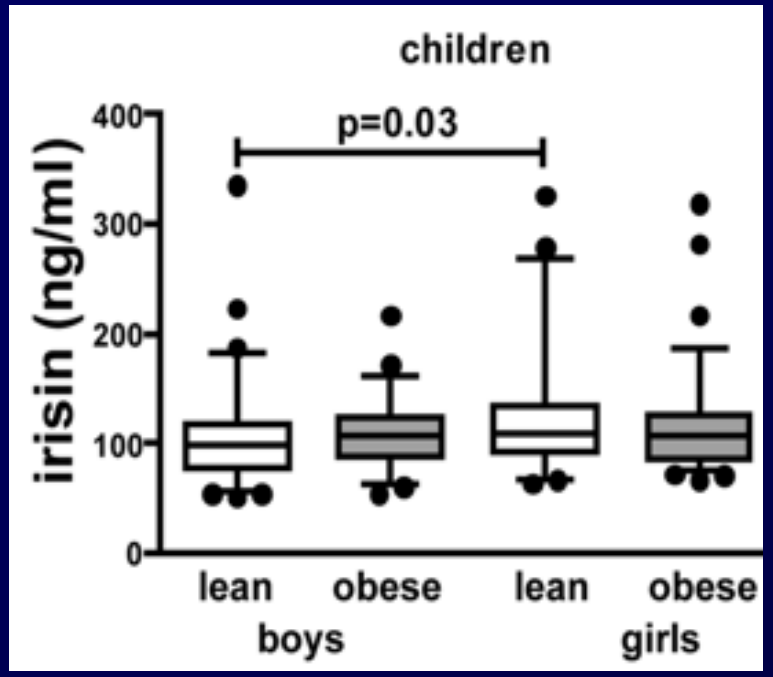
diurnal regulation, meals, and glucose.

muscle mass and obesity、Age、sex

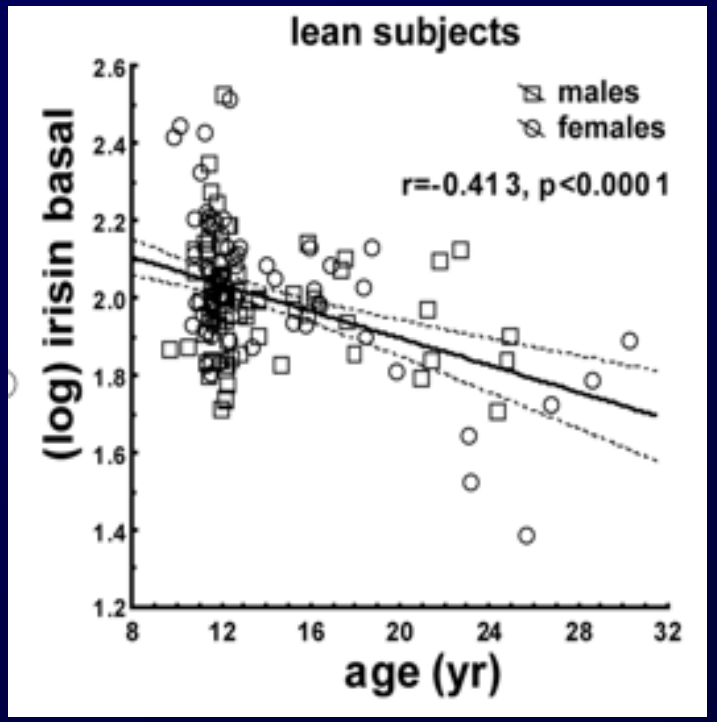
different exercise schemes on irisin levels in children and young adults.



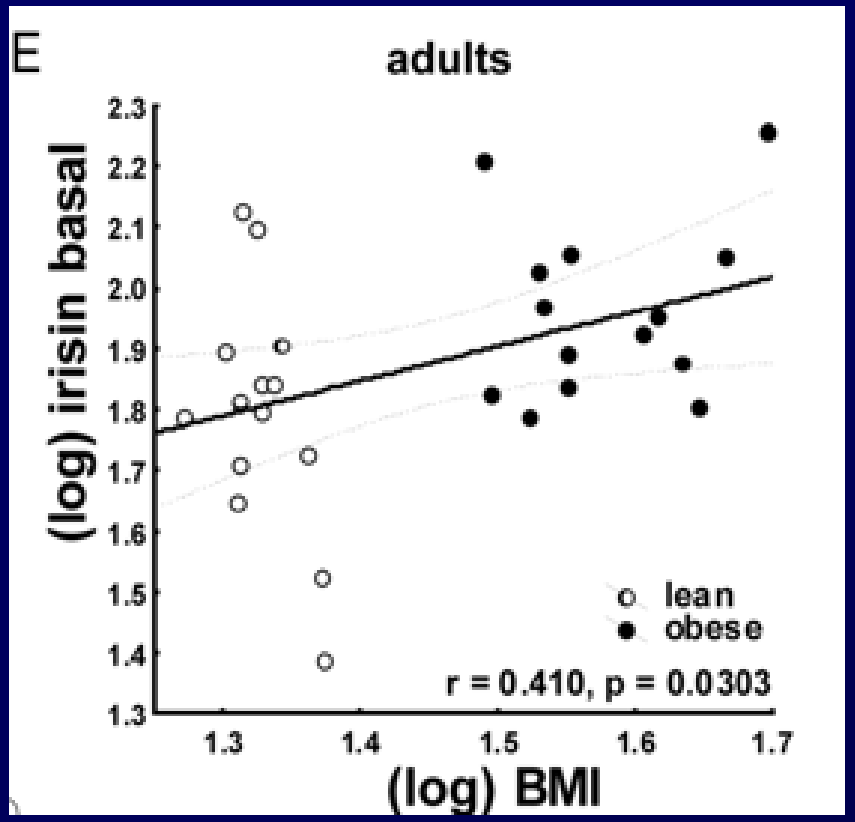
瘦的成年人中，男性的平均鸢尾素水平高于女性，肥胖女性的鸢尾素水平高于瘦女性



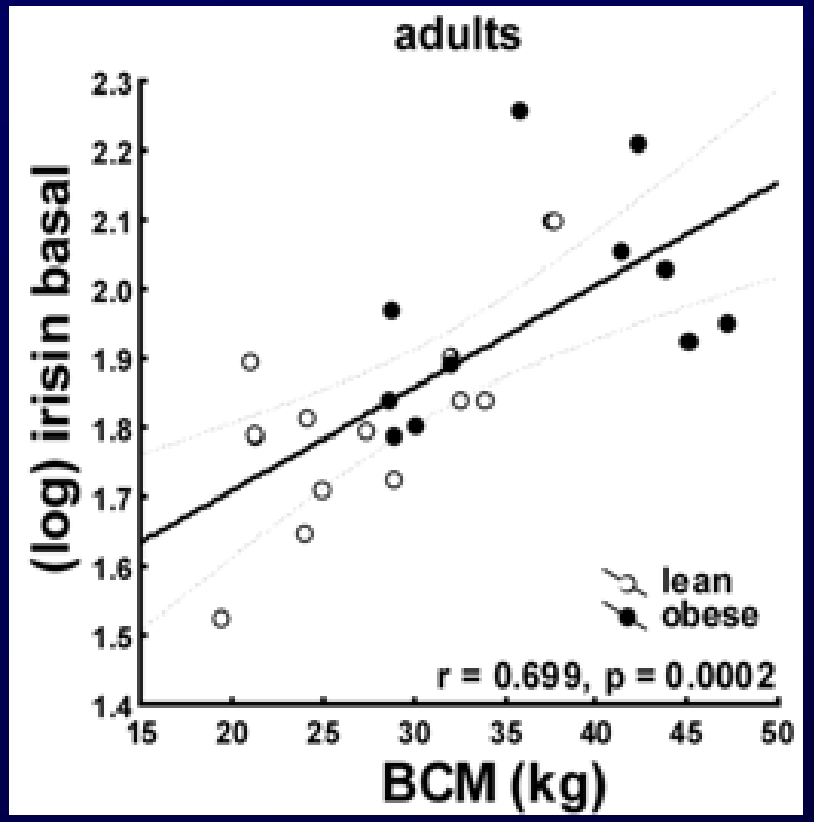
在瘦的儿童中，女孩的平均鸢尾素水平高于男孩



将四组的年龄与Irisin同时进行相关分析，血清鸢尾素水平与年龄呈负相关



年轻人中BMI与Irisin呈正相关



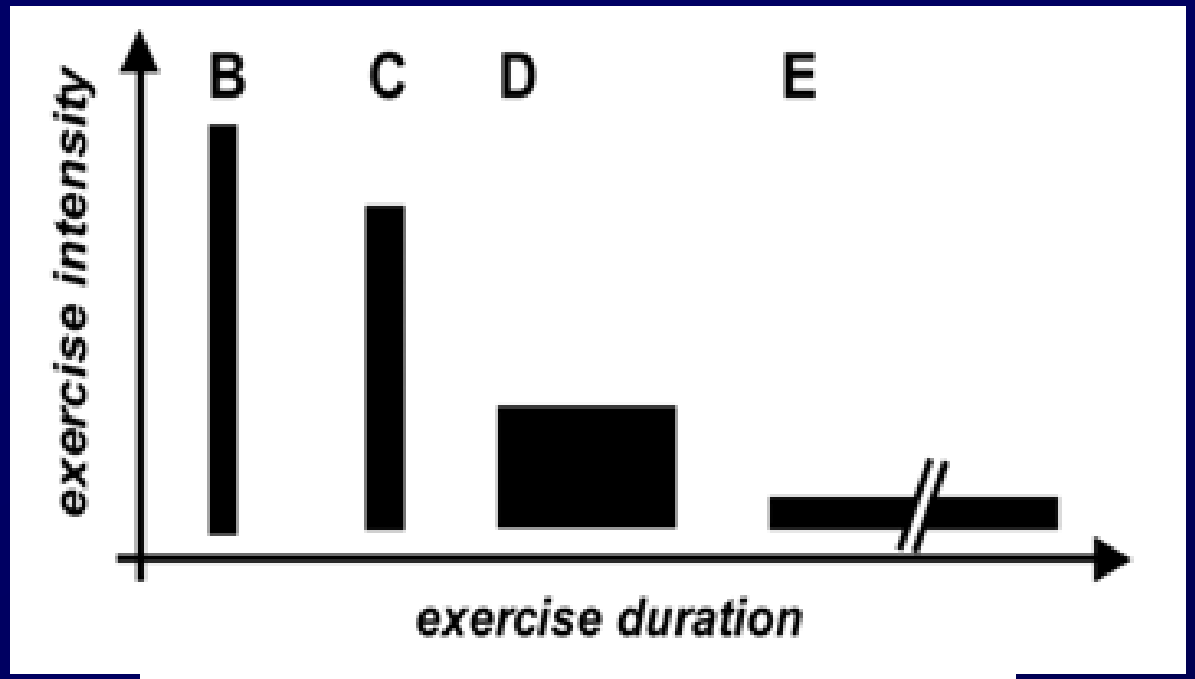
肌肉组织中BCM（细胞量）与Irisin呈正相关

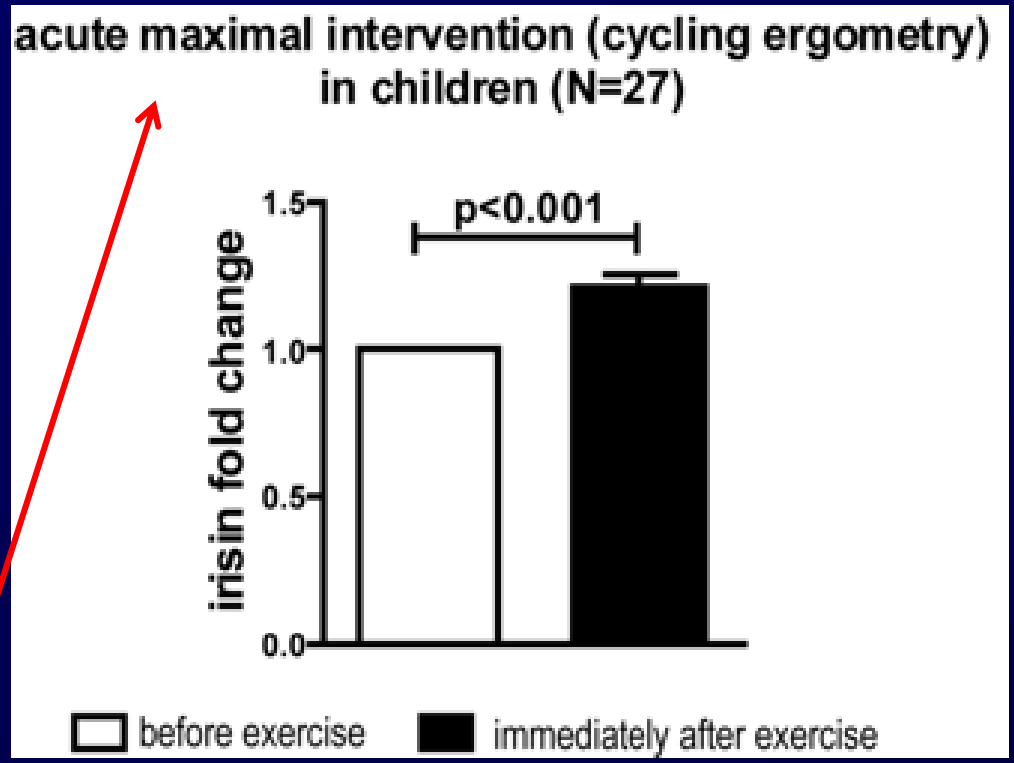
What can change serum Irisin levels?

diurnal regulation, meals, and glucose.

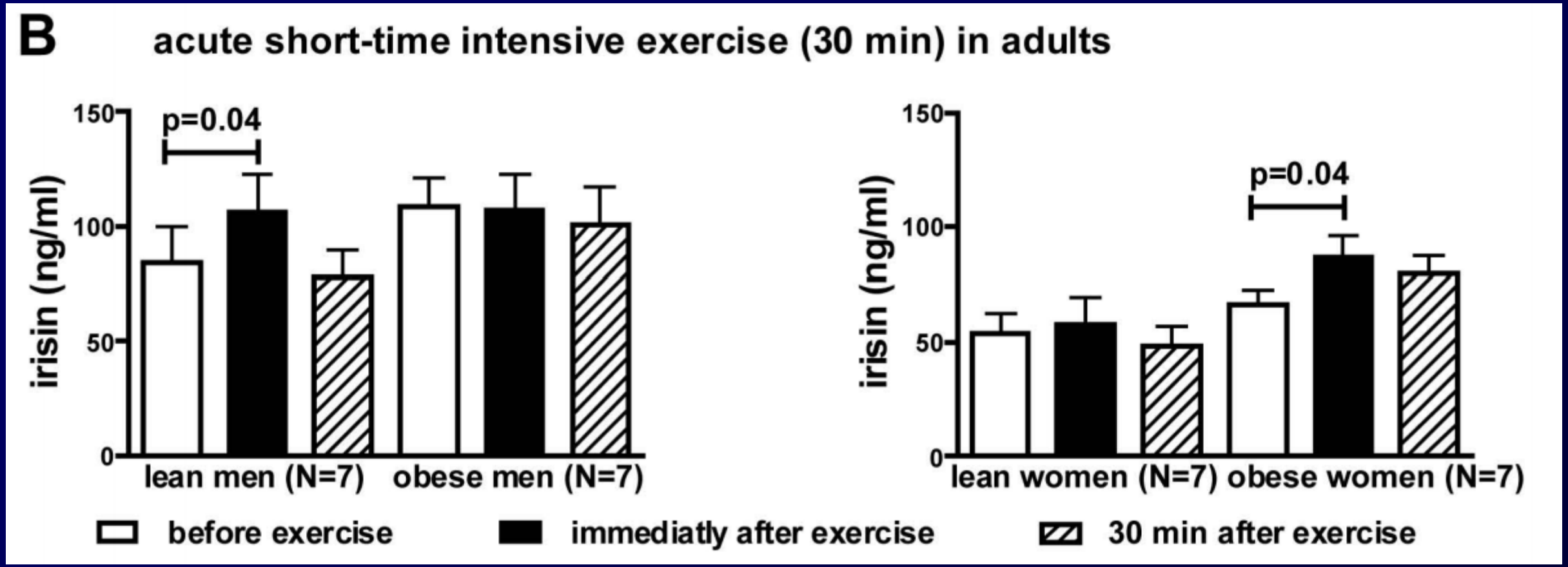
muscle mass and obesity、Age、sex

different exercise schemes on irisin levels in children and young adults.

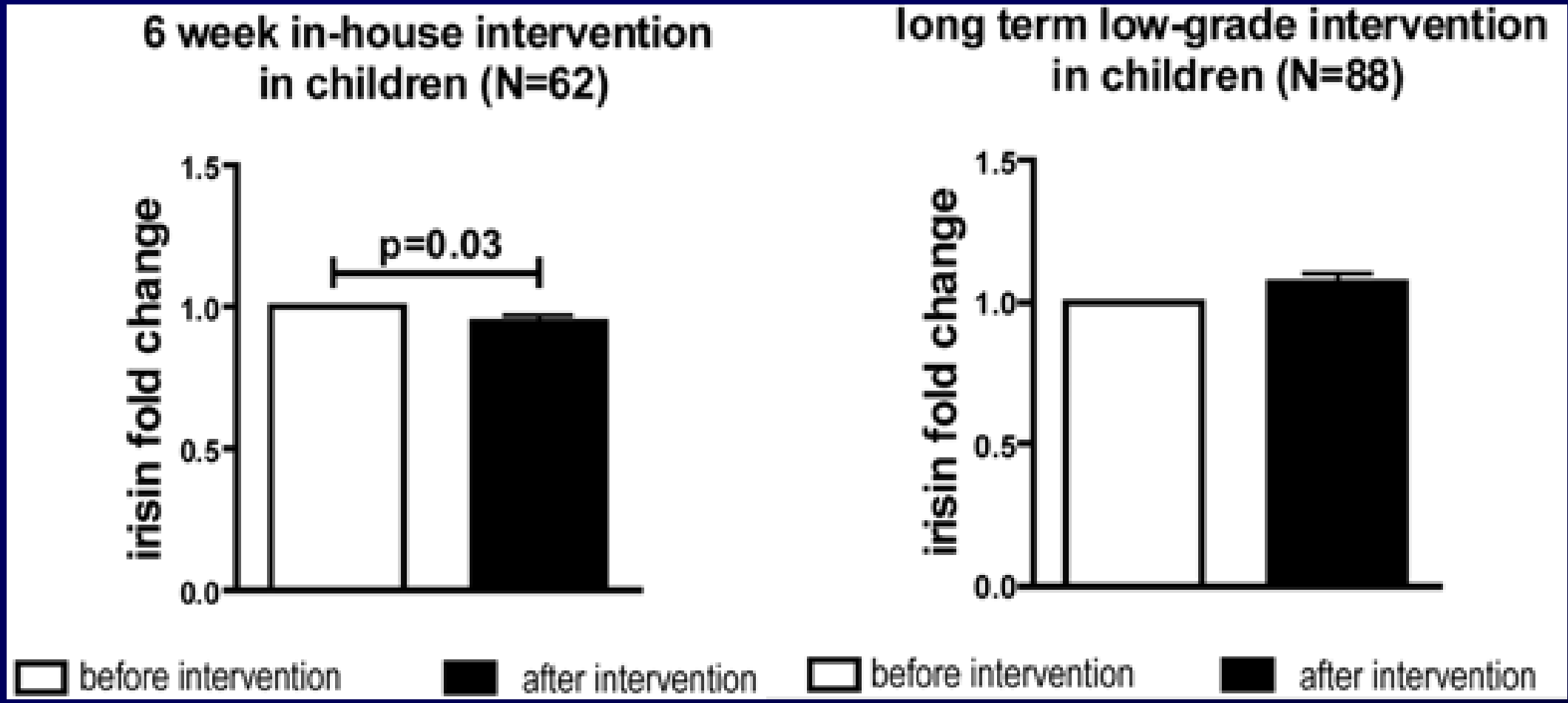




骑行法进行15分钟测试，所有受试者的血清鸢尾素水平相关地增加至平均123%，运动完后立刻进行Irisin测定



进一步分析发现，在瘦男性和肥胖女性中运动后可以观察到显著地Irisin增加，且这种增加只能立即检测到，运动30分钟后会消失。



长期干预：

在6周的长期运动，以及更为长期的低级干预训练下，

血浆Irisin水平没有变化

小结：

1、作者通过四组不同特征的人群，设定四种运动方式对Irisin进行测定，根据相关系数进行分析发现在成人中，鸢尾素水平受年龄，性别，肥胖和肌肉BCM的影响，而昼夜节律和膳食不会导致鸢尾素水平的变化。

2、短期的强化运动可以促进儿童和青年的Irisin水平

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Resistance exercise induces a greater irisin response than endurance exercise

Yoshifumi Tsuchiya[a], Daisuke Ando[b,1], Kaoru Takamatsu[c], Kazushige Goto[a,*]

阻力运动可比耐力运动引起更大的鸢尾素反应

研究目的

① 通过使用不同的运动模式研究Irisin对急性运动反应时间的详细变化

② 耐力运动和阻力运动后对血浆Irisin的影响

进行两次实验：

实验一：静息实验：

确定12h内血浆Irisin昼夜变化：8:00-20:00

在8:00、11:00、14：00、17：00和20:00肘前静脉取血

实验二：运动实验

前期工作：受测试者在整个试验期间共进行五次实验，

①第一次首先通过重量堆叠机进行8个运动项目的1RM值测定

②第二次通过增重蹬踏测试测定最大摄氧量。通过自动气体分析仪分析摄氧量（VO_2），二氧化碳输出（VCO_2）、每分钟通气量（VE）呼吸交换比（RER）30s/次

③-⑤第三-五次，每周随机进行三种不同的运动试验：

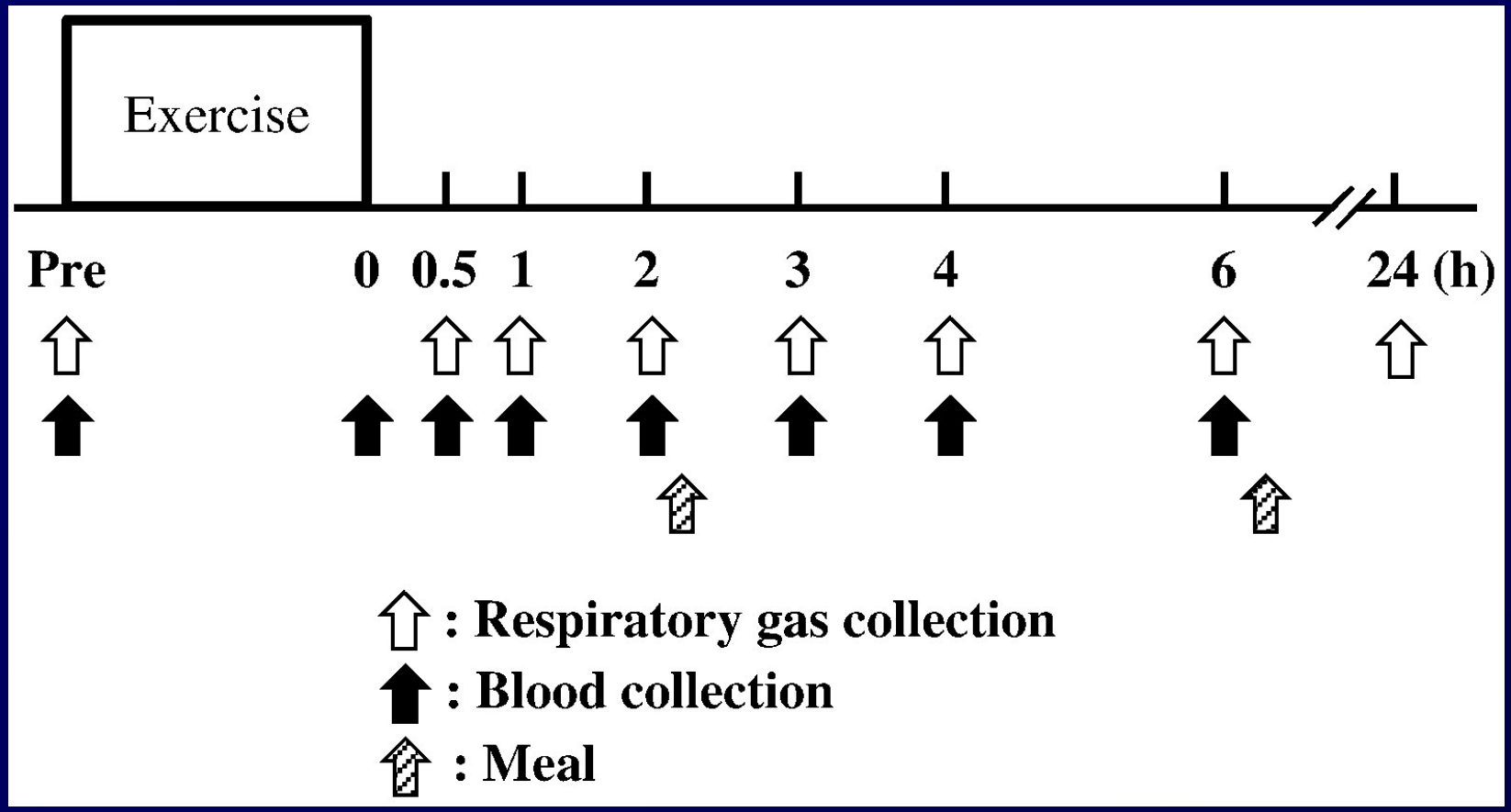
A：阻力实验 B：耐力实验 C：阻力＋耐力实验

A：进行胸部按压等8个阻力运动，以65%*1RM的强度进行训练，每组12次重复

B：进行蹬踏测试的耐力运动，在65%*VO_2MAX下踩踏60分钟，踏板频率设置为60rpm。

C：先进行30分钟的阻力运动，休息20分钟后进行30分钟的耐力运动。

三次实验总体运动时间均为1小时。

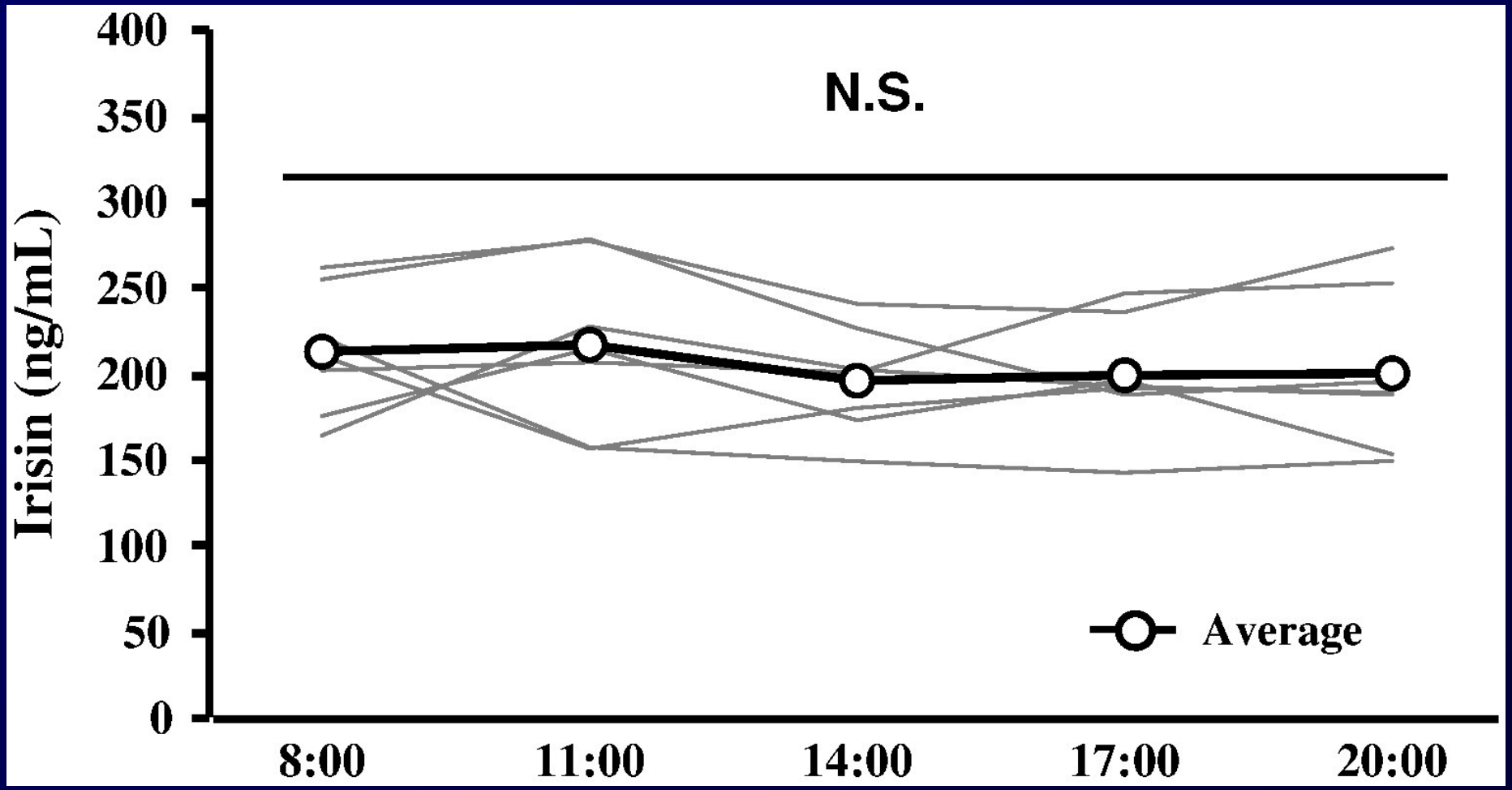


在运动前和运动后0.5,1,2,3,4和6小时处采集血样

呼吸测量使用自动气体分析仪，收集五分钟的静息呼吸气体，以确定运动前的VO_2，VCO_2和VE，以及运动后0.5,1,2,3,4,6,24小时的指标。

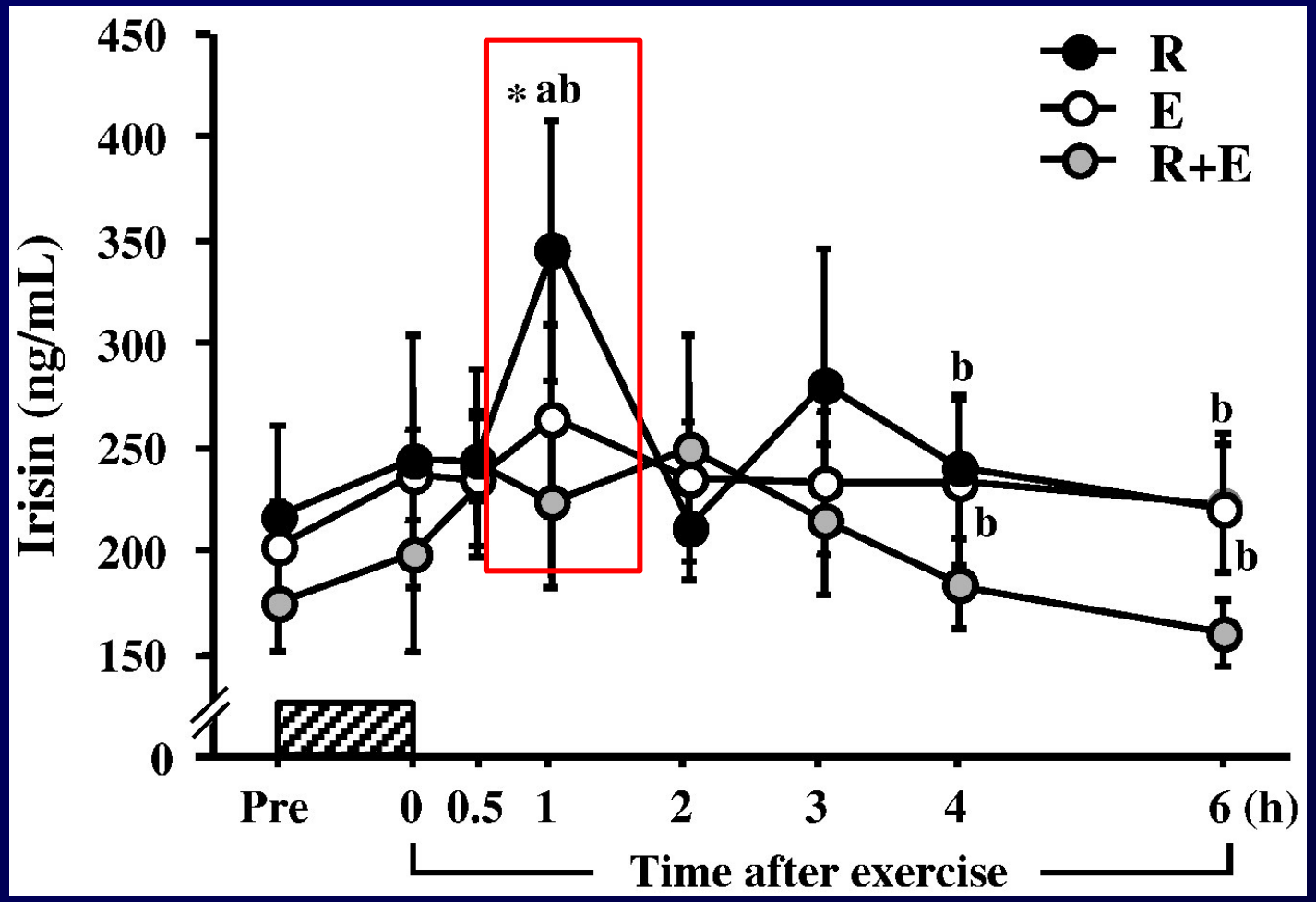
$RER=VCO_2/VO_2$

静息实验



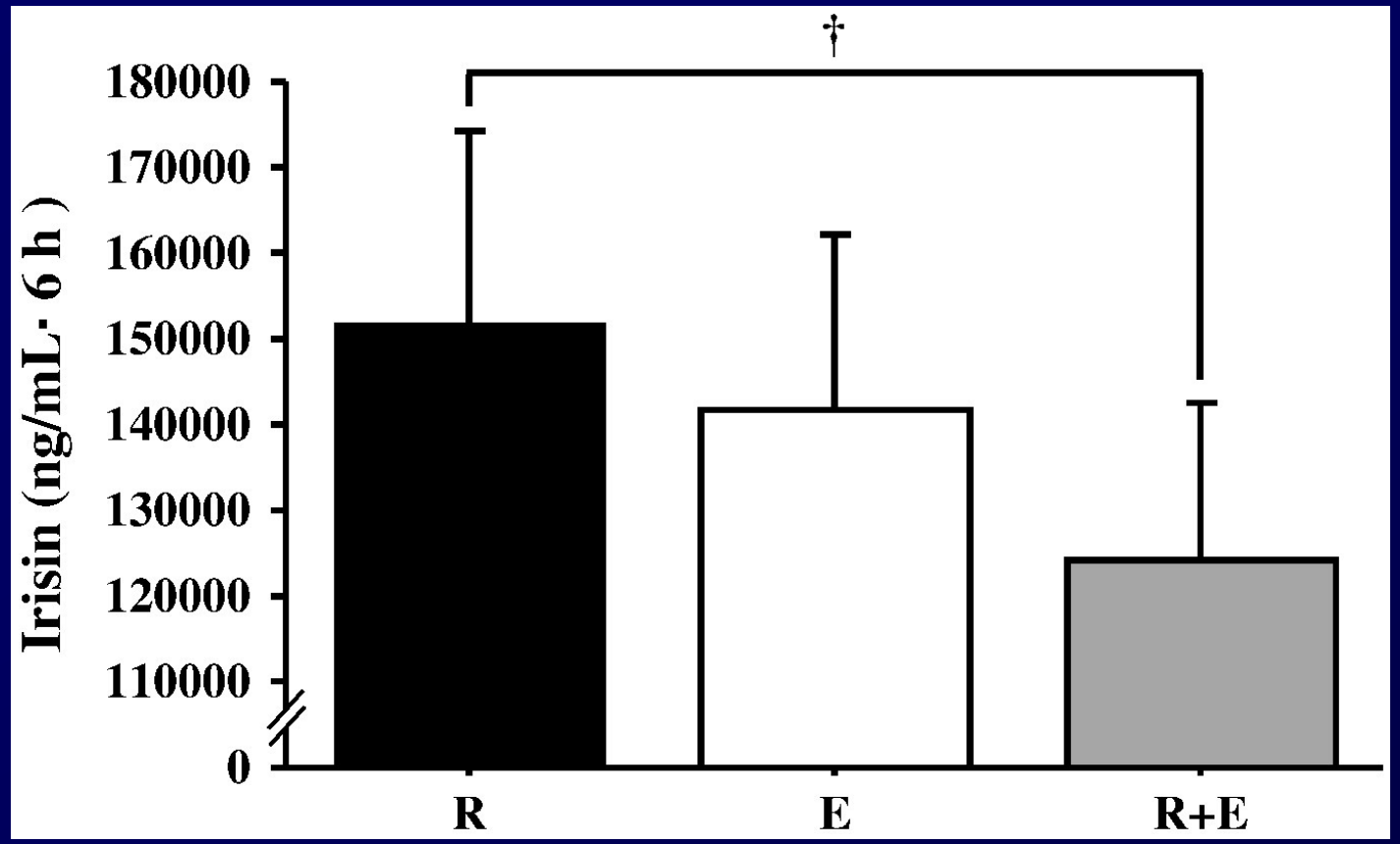
12 小时内血浆鸢尾素浓度的时间变化。
血浆浓度保持稳定，12 小时内测量点之间未观察到显着差异。

运动实验



R：阻力运动
E：耐力运动
R+E：阻力＋耐力运动

运动前后血浆鸢尾素浓度随时间的变化。
阴影框表示预热锻炼期。



R实验的AUC值显著高于E和R+E实验

运动后6小时血浆鸢尾素浓度曲线下面积（AUC）

Table 1 – Time-course changes in blood variables in each trial.

Variables		Pre	0 h	0.5 h	1 h	2 h	3 h	4 h	6 h	AUC (0–6 h)
Glucose (mg/dL)	R	85 ± 2	98 ± 5[a,b]	87 ± 5	82 ± 2[b]	89 ± 2	117 ± 6[*]	113 ± 4[*]	89 ± 2	59,302 ± 1131
	E	82 ± 2[b]	73 ± 2	84 ± 2	84 ± 2	88 ± 4	117 ± 7[*]	103 ± 3[*]	82 ± 2	56,545 ± 1222
	R + E	88 ± 2	79 ± 5	86 ± 2	89 ± 2	89 ± 2	123 ± 7[*]	111 ± 4[*]	85 ± 2	59,202 ± 1515
Lactate (mmol/L)	R	1.0 ± 0.2[a]	12.4 ± 0.5[*,a,b]	6.5 ± 0.5[*,a,b]	3.1 ± 0.2[*,a,b]	1.5 ± 0.2	1.9 ± 0.1[a]	1.5 ± 0.1[a]	1.3 ± 0.1[a,b]	1554 ± 92[a,b]
	E	1.6 ± 0.3[b]	3.9 ± 0.6[*]	1.6 ± 0.2	1.1 ± 0.1	1.1 ± 0.2	1.4 ± 0.2	1.1 ± 0.1	0.9 ± 0.1	756 ± 69
	R + E	0.9 ± 0.1	6.3 ± 0.6[*,a]	2.4 ± 0.2	1.5 ± 0.1	2.3 ± 1.2	1.5 ± 0.1	1.2 ± 0.1	1.0 ± 0.1	1043 ± 156
Insulin (μU/mL)	R	6.0 ± 1.3	10.9 ± 2.0	10.5 ± 2.7	5.8 ± 0.7	6.9 ± 1.2	42.4 ± 11.2[*]	45.1 ± 12.7[*]	12.2 ± 5.0	14,143 ± 3245
	E	5.3 ± 1.3	1.6 ± 0.6	4.2 ± 1.0	5.1 ± 0.9	5.0 ± 0.9	44.9 ± 9.2[*]	35.7 ± 5.1[*]	12.3 ± 5.0	12,206 ± 2162
	R + E	6.8 ± 1.0	4.9 ± 1.3	5.7 ± 0.7	6.1 ± 1.1	4.7 ± 0.7	53.1 ± 6.6[*]	37.7 ± 6.2[*]	9.5 ± 1.9	13,264 ± 1722
TG (mg/dL)	R	76 ± 7	72 ± 8	65 ± 8	72 ± 8	103 ± 9	103 ± 9	132 ± 13	103 ± 16[*]	57,575 ± 5840
	E	86 ± 9	86 ± 10	78 ± 9	78 ± 7	77 ± 6	98 ± 7	132 ± 9[*]	105 ± 13	59,738 ± 4752
	R + E	85 ± 14	80 ± 15	77 ± 13	77 ± 12	76 ± 12	108 ± 12	137 ± 18[*]	107 ± 21	61,275 ± 8483
FFA (μEq/L)	R	292 ± 39[a]	229 ± 14[a,b]	138 ± 24[a,b]	321 ± 21[a,b]	961 ± 76[*]	271 ± 31	202 ± 14	342 ± 37	226,693 ± 13,819[a,b]
	E	400 ± 57[b]	541 ± 51[b]	844 ± 77[b]	875 ± 57[*]	1023 ± 63[*]	252 ± 28[*]	219 ± 30[*]	322 ± 31	313,970 ± 18,626
	R + E	277 ± 40	391 ± 61	568 ± 60[*]	839 ± 100[*]	999 ± 93[*]	301 ± 50	218 ± 17	380 ± 57	301,835 ± 26,240
Glycerol (mg/L)	R	2.9 ± 0.4	20.4 ± 6.2[*]	11.6 ± 2.7	7.4 ± 1.6	8.4 ± 0.8	5.7 ± 0.9	9.8 ± 0.8	6.0 ± 0.9	5142 ± 584
	E	3.7 ± 0.5	16.7 ± 1.5[*]	8.3 ± 1.6[*]	6.6 ± 0.7	7.7 ± 0.9[*]	5.1 ± 0.7	9.7 ± 0.8[*]	5.6 ± 0.5	4643 ± 275
	R + E	2.8 ± 0.5	15.9 ± 2.4[*]	8.6 ± 1.3[*]	8.0 ± 1.4[*]	7.1 ± 0.8	6.0 ± 1.4	11.1 ± 1.2[*]	6.0 ± 1.2	4999 ± 502
Myoglobin (ng/mL)	R	37 ± 2	84 ± 10[*]	111 ± 17[*]	154 ± 21[*]	144 ± 20[*]	107 ± 13[*]	87 ± 11[*]	71 ± 7	66,850 ± 8176
	E	48 ± 7	50 ± 7[b]	90 ± 24	134 ± 34	191 ± 53[*]	195 ± 56[*]	194 ± 51[*]	160 ± 6[*]	99,580 ± 28,255
	R + E	39 ± 8	132 ± 27[*]	160 ± 38[*]	157 ± 36[*]	121 ± 26[*]	87 ± 16	73 ± 13	57 ± 9	62,802 ± 13,166
CK (μmol/L)	R	158 ± 21	238 ± 27[*]	235 ± 25[*]	236 ± 23[*]	261 ± 24[*]	277 ± 27[*]	284 ± 29[*]	306 ± 34[*]	162,410 ± 16,080
	E	314 ± 90	353 ± 95	324 ± 86	325 ± 85	364 ± 90	407 ± 96	469 ± 113	579 ± 147[*]	254,684 ± 59,794
	R + E	200 ± 77	287 ± 83	288 ± 77	302 ± 77[*]	322 ± 76[*]	332 ± 79[*]	335 ± 79[*]	342 ± 77[*]	194,145 ± 11,990
Total Ketone body (μmol/L)	R	41 ± 4	47 ± 4[a,b]	43 ± 2[a]	41 ± 3[a]	208 ± 44[*,a]	73 ± 8	55 ± 4	81 ± 18	50,778 ± 5865[a]
	E	74 ± 29	87 ± 9	185 ± 36[b]	233 ± 47[*]	435 ± 81[*]	112 ± 24	54 ± 5	58 ± 6	97,508 ± 15,499
	R + E	48 ± 10	70 ± 6	80 ± 7	140 ± 29	315 ± 59[*]	89 ± 10	56 ± 4	94 ± 25	74,430 ± 10,649

E试验导致运动前血糖浓度显着低于R+E试验中的血糖浓度
R试验中的血糖浓度显着高于运动后的E和R+E试验

Table 2 – Time-course changes in respiratory gas data in each trial.

Variables		Pre	0.5 h	1 h	2 h	3 h	4 h	6 h	24 h
VO_2 (ml/min)	R	256 ± 8	309 ± 10*	276 ± 5	283 ± 8	320 ± 13*	313 ± 19*	281 ± 6	255 ± 7
	E	248 ± 8	301 ± 9*	293 ± 7*	290 ± 7*	309 ± 6*	301 ± 6*	288 ± 10*	263 ± 8
	R + E	273 ± 7	304 ± 15*	297 ± 9	289 ± 7	302 ± 6	320 ± 11*	292 ± 9	255 ± 6
VCO_2 (ml/min)	R	211 ± 7	217 ± 12	202 ± 4	212 ± 6	260 ± 9*	256 ± 19*	225 ± 4	211 ± 5
	E	208 ± 7	233 ± 9	219 ± 7	225 ± 6	249 ± 10*	283 ± 6	235 ± 8	218 ± 6
	R + E	234 ± 10	227 ± 15	235 ± 19	232 ± 21	244 ± 21	259 ± 10	234 ± 8	208 ± 6
RER	R	0.83 ± 0.02	0.70 ± 0.03*	0.74 ± 0.02*	0.75 ± 0.02*	0.81 ± 0.02	0.81 ± 0.01	0.80 ± 0.01	0.83 ± 0.02
	E	0.84 ± 0.02	0.77 ± 0.02*	0.75 ± 0.01*	0.78 ± 0.02	0.80 ± 0.02	0.79 ± 0.01	0.82 ± 0.01	0.83 ± 0.01
	R + E	0.86 ± 0.03	0.75 ± 0.02	0.79 ± 0.05	0.80 ± 0.06	0.81 ± 0.03	0.81 ± 0.02	0.80 ± 0.01	0.82 ± 0.02

Values are means ± SE.
* $P < 0.05$ vs. Pre.

测定每个实验呼吸气体数据的变化，

VO_2， VCO_2和RER（VCO_2/VO_2）随着运动时间的增加而增加

Variables	Irisin	
	r	*P* value
Glucose	0.37	0.046
Lactate	0.45	0.012
Insulin	0.07	0.651
TG	0.09	0.649
FFA	0.32	0.084
Glycerol	0.45	0.012
Myoglobin	− 0.01	0.972
CK	0.15	0.438
Total ketone body	− 0.11	0.569

血浆Irisin浓度的AUC与血糖、乳酸和血清中甘油浓度显著相关

resistance exercise caused a more profound elevation in irisin concentration compared with that of endurance exercise and the combination of resistance and endurance exercise under equivalent exercise duration.

设计两种实验，8种运动模式，利用血浆理化分析和呼吸测定分析，阻力试验显示运动后1小时血浆鸢尾素浓度显着增加，Irisin与血糖、乳酸、以及血清甘油含量的AUC值有相关关系。

汇报完毕，请各位老师同学

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