



The role of
colostrum to
control pre-
weaning enteritis
初乳在防治仔猪
断奶前肠炎中的
作用



猪消化道疾病国际研讨会
International Pig Digestive Diseases Symposium

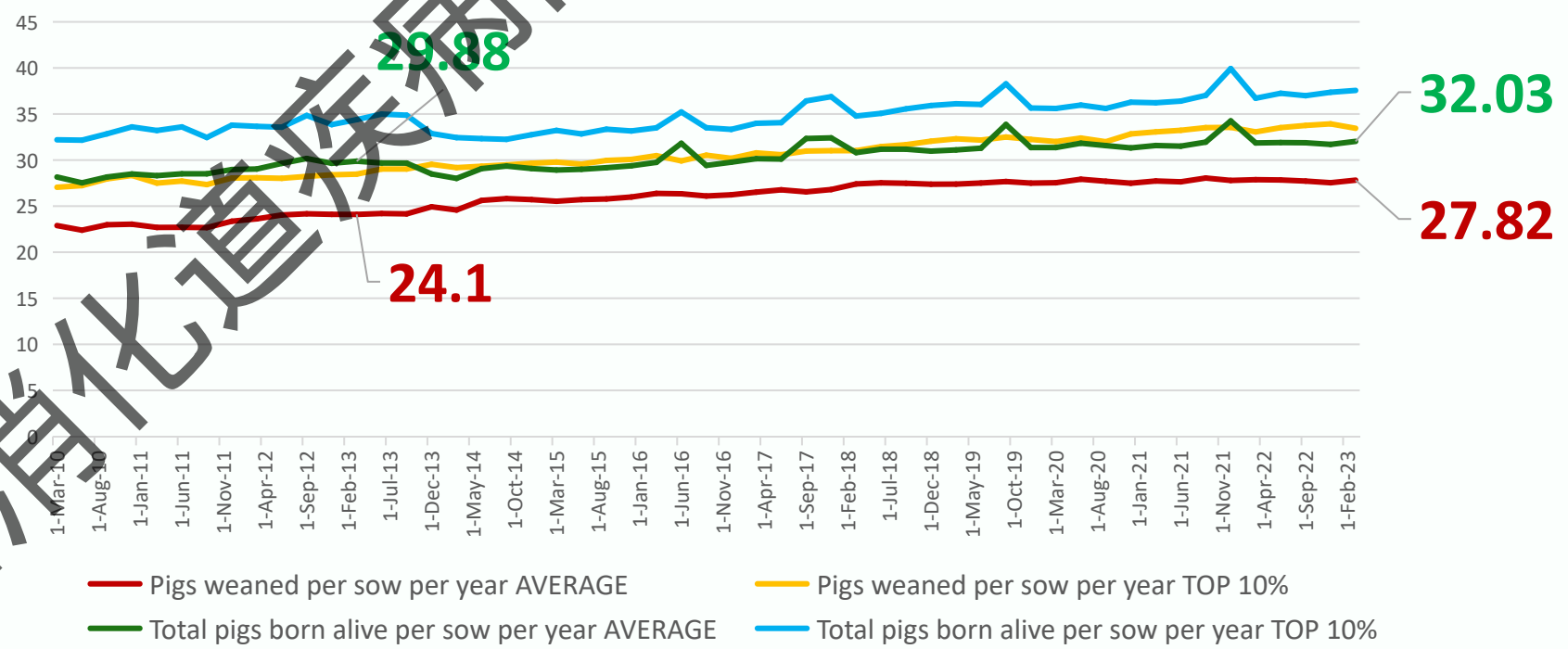
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General trends Europe 欧洲总体趋势

- ZnO banned in post-weaning diets (above maintenance levels)
断奶后日粮中禁止使用氧化锌（高于维持水平）
- Reduction of antimicrobial use 减少抗微生物药物的使用
- Increase in numbers born 出生仔猪数增加

Breeding herd (indoor) performance GB 英国种猪群（室内）性能





General trends for breeding herds

种猪群的总体趋势

↑ overall piglets born (genetics) 出生的仔猪总数（遗传学）

↓ birth weights 出生体重

↑ low viability piglets and stillborns 低存活率仔猪和死胎

↑ intra-uterine growth retardation (IUGR) 宫内发育迟缓（IUGR）

↑ competition for limited teats 竞争有限的乳头

↑ variability in colostrum intake 初乳摄入量的可变性

↑ pigs born alive = ↑ pre-weaning mortality (PWM)

↑ 活产仔猪 = ↑ 断奶前死亡率（PWM）

(sow, piglet, environment and infection factors)

（母猪、仔猪、环境、感染因素）

Unless you manage everything well!

除非你把一切都管理好！



Aim of the breeding herd: 种猪群的目标:

Wean many strong piglets (kg sold/s/y)

给许多健壮的仔猪断奶（售出公斤/母猪/年）

- ↓ PWM
- ↓ 断奶前死亡率

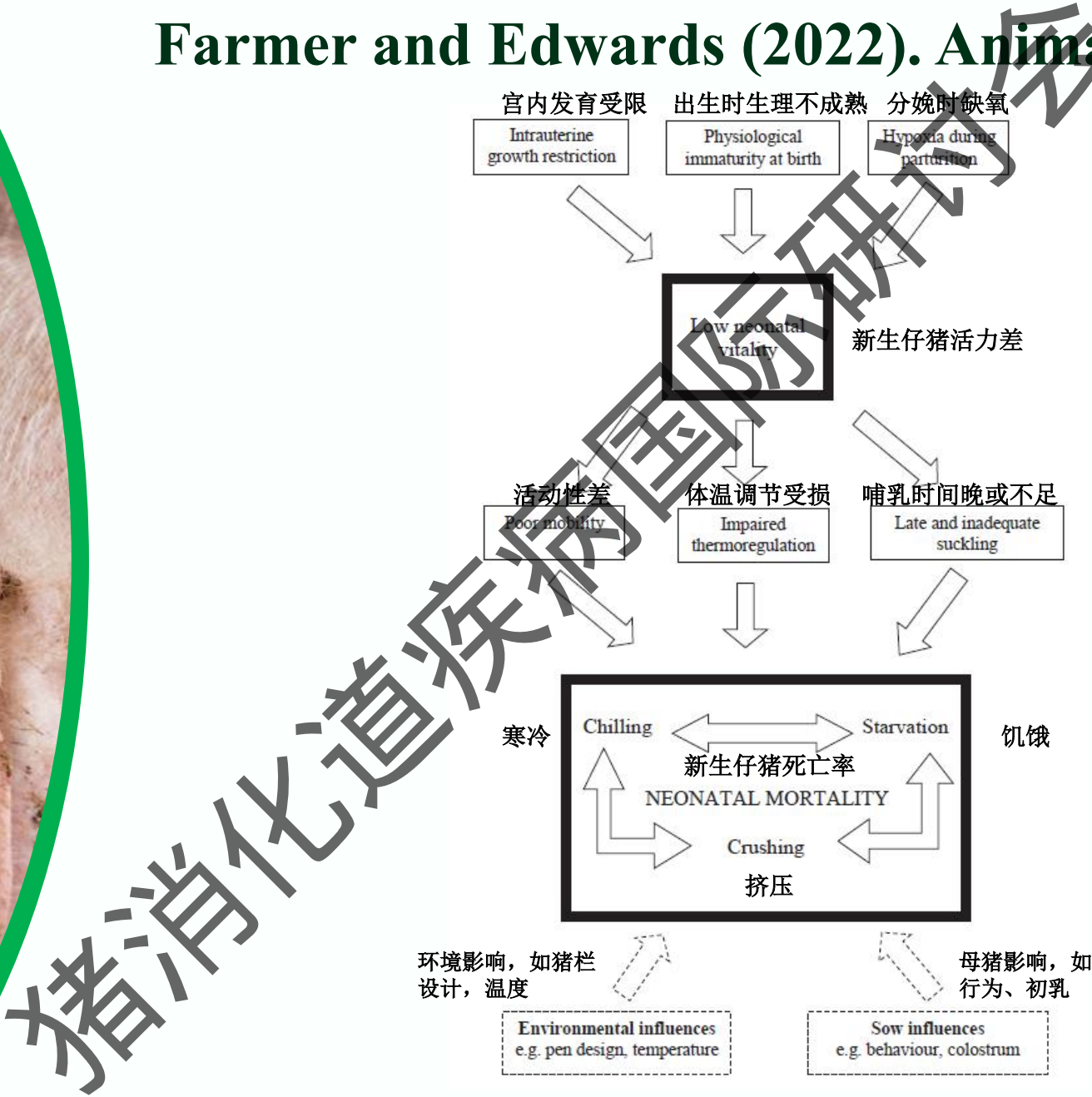
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Farmer and Edwards (2022). Animal 16: 100350



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Aim of the breeding herd: 种猪群的目标:

Wean many strong piglets (kg sold/s/y)

给许多茁壮的仔猪断奶（售出公斤/母猪/年）

- ↓ PWM 断奶前死亡率
- Healthy digestive system ready for diet change
- 健康的消化系统为日粮变化做好准备
 - Anatomy 解剖学
 - Microbiome 微生物组
- Overall immunity, health and future performance
- 整体免疫力、健康和未来性能

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Common solutions to pre-wean diarrhoea

断奶前腹泻的常见解决方案

- Biosecurity (exclusion, management, containment)
- 生物安全 (排除、管理、抑制)
- Colostrum management
- 初乳管理
- Neonate (environment) management
- 新生仔猪 (环境) 管理
- Sow nutrition
- 母猪营养
- Vaccination
- 免疫接种



A newborn piglet needs colostrum 新生仔猪需要初乳

Colostrum intake is **essential** for survival after birth

初乳摄入对仔猪出生后的生存至关重要

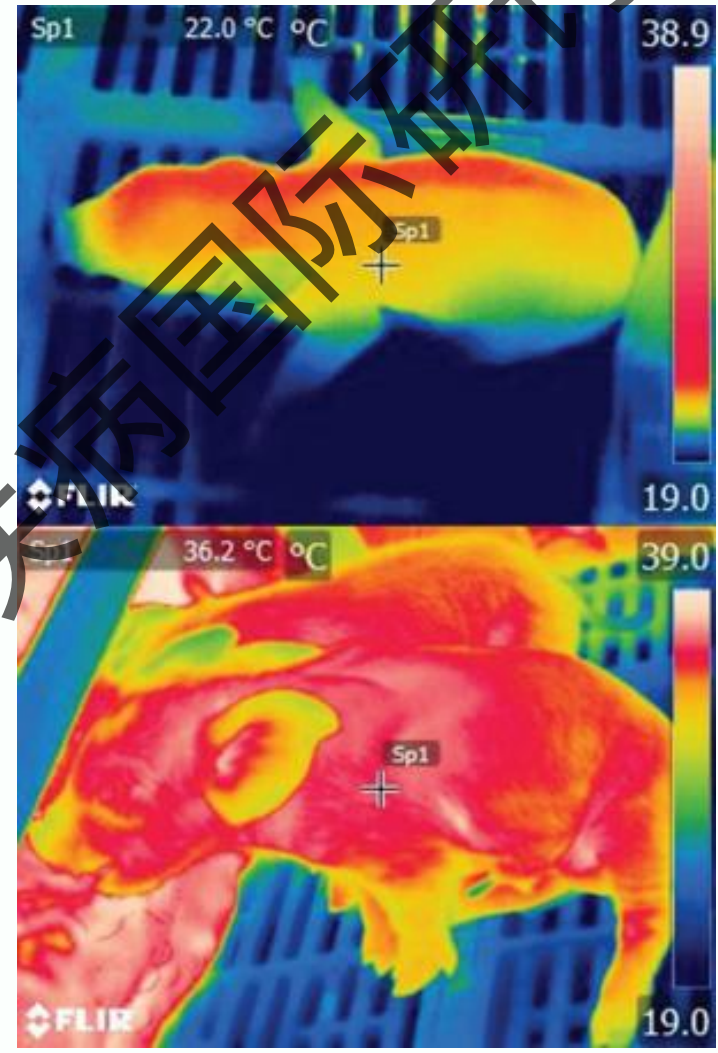
- Piglets are born with low energy (glycogen) reserves
- 仔猪出生时能量（糖原）储备低





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Grahofer and Plush (2023). *Animal Frontiers* 13(3):105-111

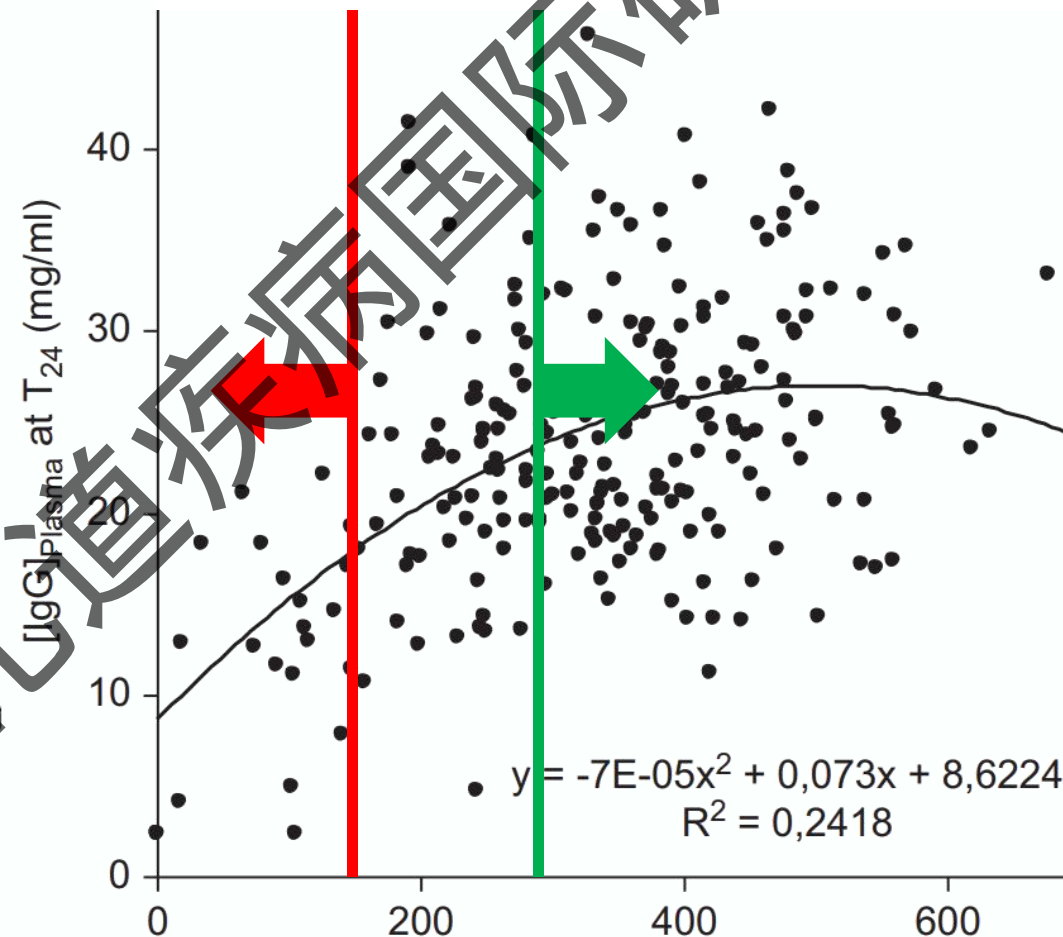




Quesnel et al (2012). *Livestock Science* 146: 105–114

Piglet IgG 24h after birth vs colostrum intake

B 50 - 仔猪出生后24小时IgG与初乳摄入量的比较



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Why else is colostrum important? 初乳为什么重要?

Low antigenic intrauterine environment

低抗原性宫内环境

Antigen rich external environment

富含抗原的外环境

No prenatal antibodies

没有产前抗体

Limited cell-mediated immunity

有限的细胞免疫

No effector and memory T lymphocytes

没有效应器和记忆性T淋巴细胞

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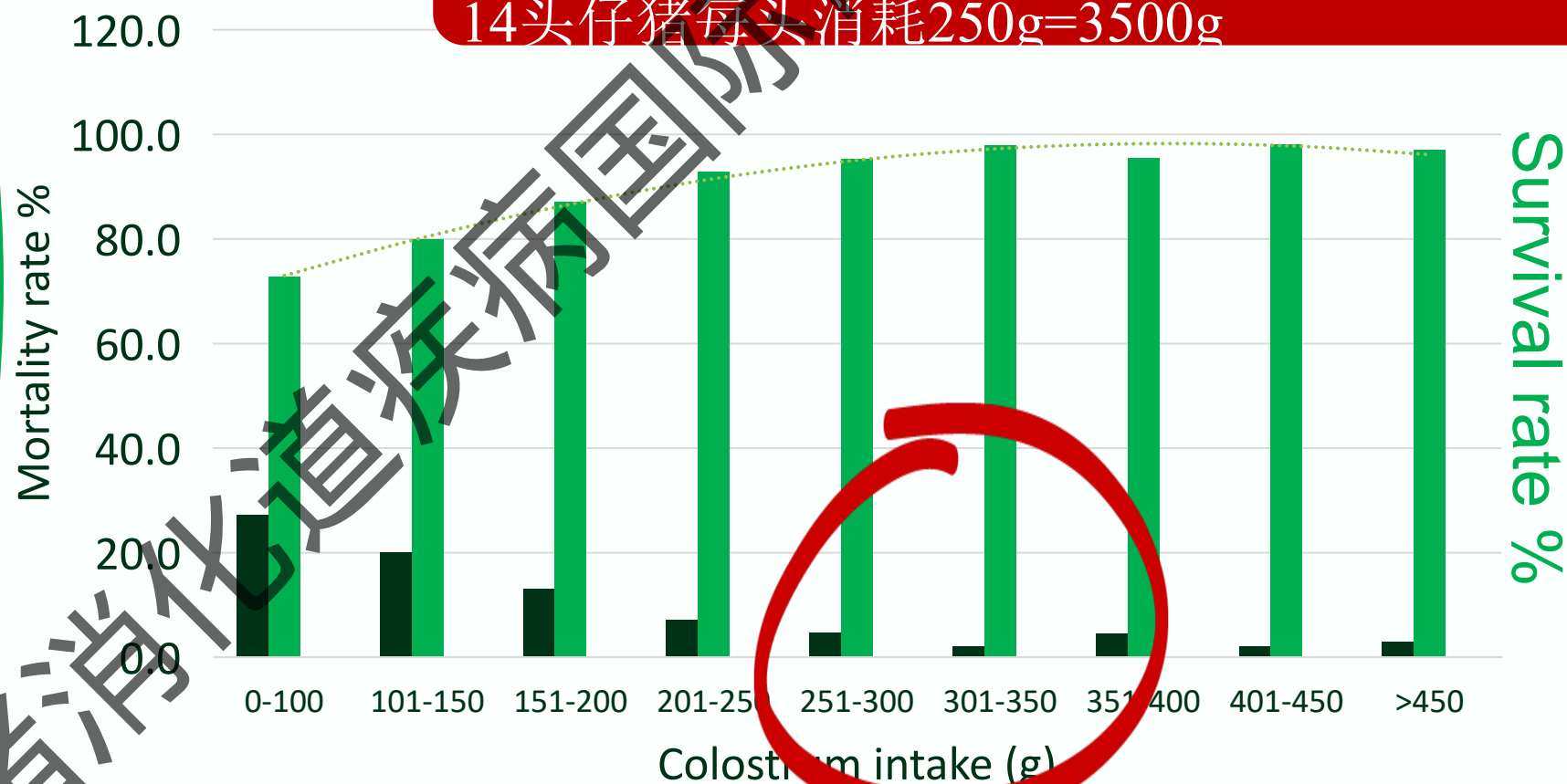
Why else is colostrum important? 初乳为什么重要？

- **Ig and leucocytes (T cells)** 免疫球蛋白和白细胞（T 细胞）
 - Serum IgG (piglets) is correlated with colostrum intake
 - 仔猪血清IgG与初乳摄入量相关



Ferrari et al (2014). Preventive Veterinary Medicine 114: 259–266

Colostrum requirements: 初乳要求:
14 piglets consuming 250g each = 3500 g
14头仔猪每头消耗250g=3500g



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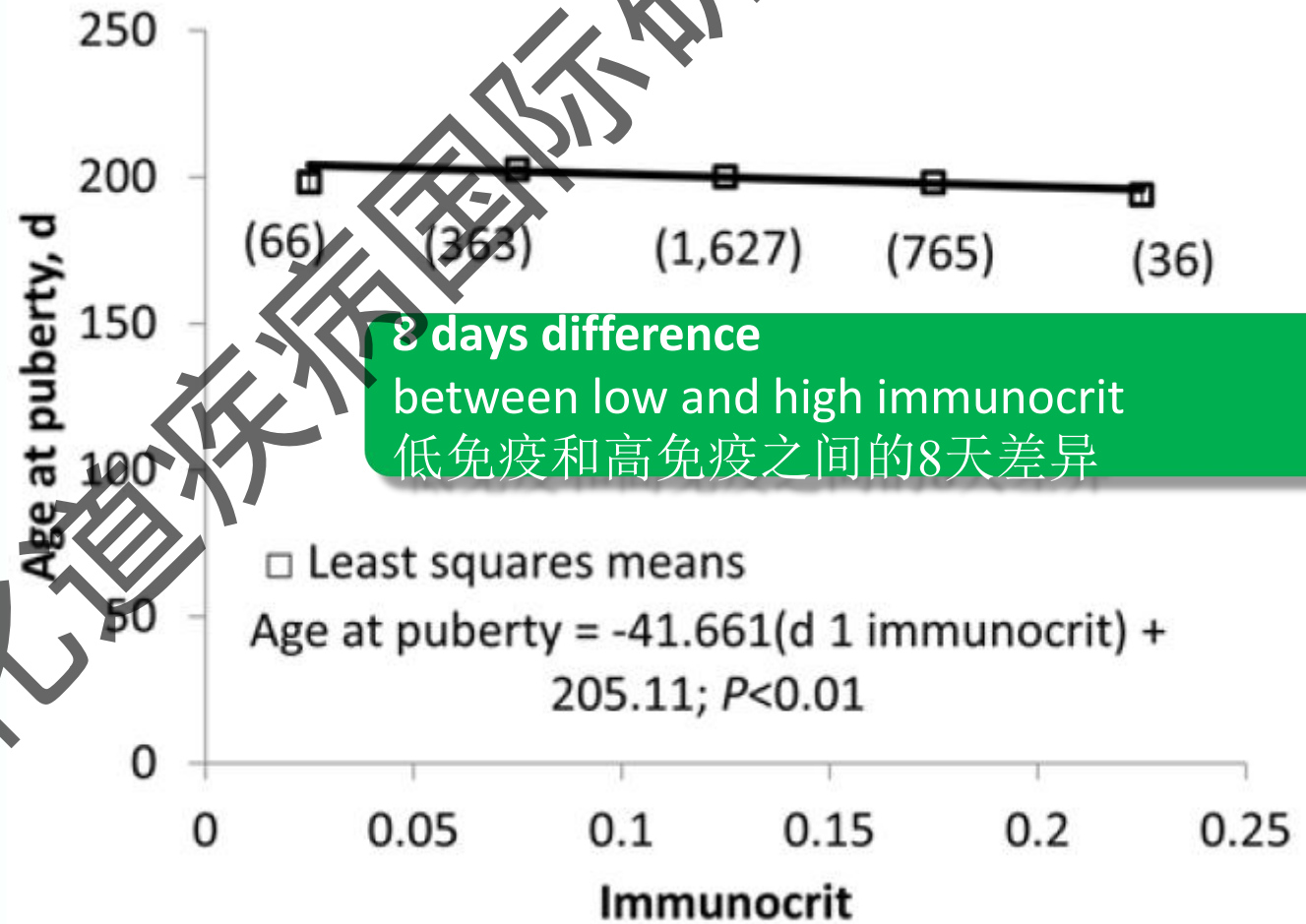


Why else is colostrum important? 初乳为什么重要？

- **Ig and WBC** 免疫球蛋白和白细胞
- **Anti-infective factors:** 抗感染因素:
 - **Neutrophils: ingest bacteria** 中性粒细胞: 摄取细菌
 - **Whey and fat: bind with enterotoxigenic bacteria** 乳清和脂肪: 与产肠毒素菌结合
 - **Unsaturated fatty acids and monoglycerides: can kill enveloped viruses**
 - **不饱和脂肪酸和单甘酯: 可杀死包膜病毒**
 - **Hydrolytic products of milk fat: kill single-cell parasites** 乳脂的水解产物: 杀死单细胞寄生虫
- **Trace elements (Fe, Zn, Co, Se) and vitamins (D, E, B12, A)**
- **微量元素 (Fe、Zn、Co、Se) 和维生素 (D、E、B12、A)**
- **Functional molecules** 功能分子
 - **insulin, growth hormones, immune modulators, steroids,**
 - **胰岛素, 生长激素, 免疫调节剂, 类固醇,**



Vallet et al (2015). J. Anim. Sci. 93:2722–2729



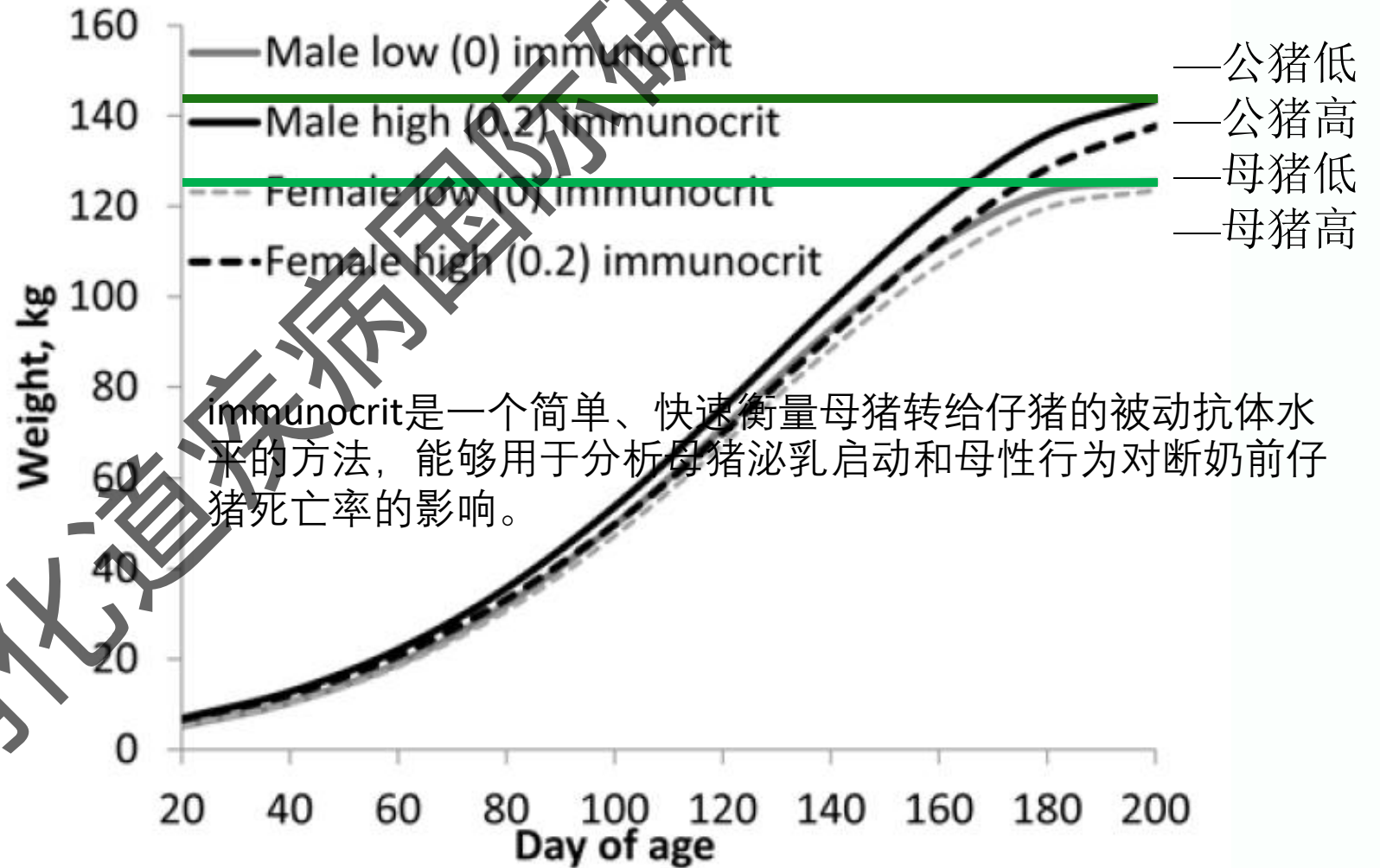


Why else is colostrum important? 初乳为什么重要？

- Gut closure (cessation of absorption of intact Igs)
- 肠道闭合（停止吸收完整的免疫球蛋白）
- Gut maturation (weight GIT \uparrow 40% in 1st 24h)
- 肠道成熟（第1个24小时体重GIT \uparrow 40%）



Vallet et al (2015). J. Anim. Sci. 93:2722–2729



immunocrit是一个简单、快速衡量母猪转给仔猪的被动抗体水平的方法，能够用于分析母猪泌乳启动和母性行为对断奶前仔猪死亡率的影响。

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Why else is colostrum important? 初乳为什么重要？

- Gut closure 肠道关闭
- Gut maturation (weight GIT \uparrow 40% in 1st 24h)
- 肠道成熟（体重GIT在第一个24小时 \uparrow 40%）
- Stimulates healthy intestinal flora (microbiota)
- 刺激健康的肠道菌群（微生物群）
- Stimulates intestinal wall development 刺激肠壁发育
- Stimulates the brain development (hippocampus especially)
- 刺激大脑发育（尤其是海马体）



Summary 总结



Sufficient colostrum (>250g) will help to wean more and healthy pigs with good performance potential
充足的初乳 (>250克) 将有助于断奶更多健康的猪, 具有良好的生产潜力

1. Colostrum provides energy to keep pigs alive
初乳提供能量使猪存活
2. Colostrum provides Ig and anti-infective factors to help piglets fight antigens
初乳提供免疫球蛋白和抗感染因子, 帮助仔猪对抗抗原。
3. Colostrum stimulates a healthy microbiome
初乳刺激健康的微生物群
4. Colostrum intake provides functional molecules that help future performance
初乳的摄入提供了有助于未来性能的功能性分子
 1. Better growth 生长更好
 2. Younger at puberty 初情期提前



Piglet serum IgG from colostrum

初乳血清IgG

- | | |
|--------------------------|------|
| 1. Quality of colostrum | 初乳质量 |
| 2. Quantity of colostrum | 初乳数量 |
| 3. Intake of colostrum | 初乳摄入 |

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Serum IgG from colostrum 初乳血清IgG

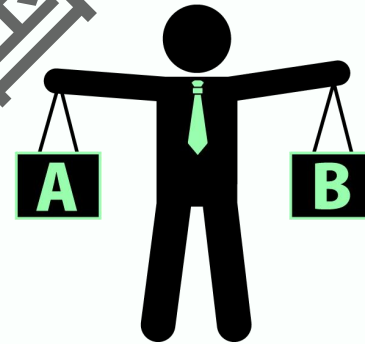
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Hasan et al (2016). *Animal* 10 (10): 1728–1733
Hasan et al (2015). ESPHM poster



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Colostrum collection: 初乳收集
0,2,4,6,8,10,16,24h after start of farrowing
分娩开始后0、2、4、6、8、10、16、24小时



Souza et al (2021). Arq. Bras. Med. Vet. Zootec., v.73, n.5, p.1047-1057

“despite both digital and optical Brix refractometers showed potential in determining colostrum quality if compared to ELISA, **digital** refractometers should be the option for on farm analysis as it has the best correlation coefficient”

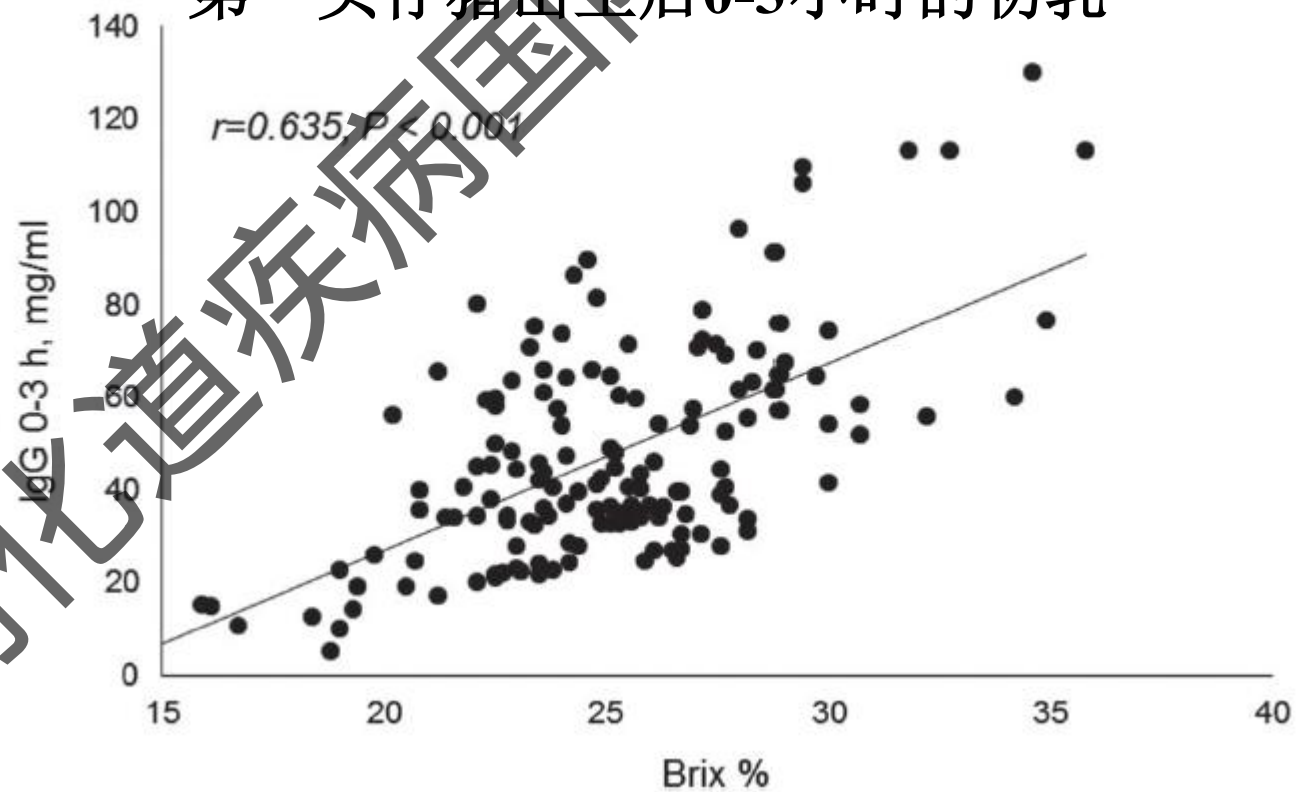
“尽管与ELISA相比，数字和光学Brix糖度计在确定初乳质量方面都显示出了潜力，但**数字**糖度计应该是猪场进行分析的选择，因为它具有最好的相关系数。”

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Hasan et al (2016). *Animal* 10 (10): 1728–1733
Hasan et al (2015). ESPHM poster

Colostrum 0-3h after birth of first piglet
第一头仔猪出生后0-3小时的初乳





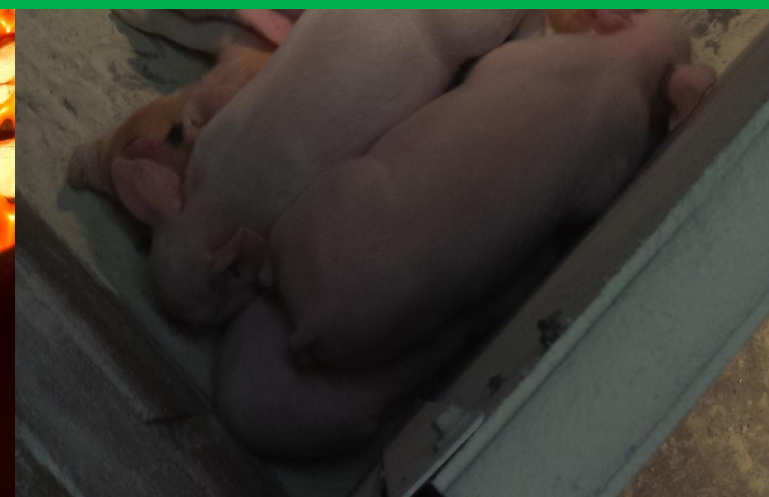
Hasan et al (2016). Animal 10 (10): 1728–1733
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Colostrum 0-3h after birth of first piglet
第一头仔猪出生后0-3小时的初乳

ELISA IgG	Brix %	IgG estimation category IgG估计类别
14.5 ± 1.8	< 20	Poor 不足
43.8 ± 2.3	20-24	Borderline 勉强够
50.7 ± 2.1	25-29	Adequate 充足
78.6 ± 8.4	≥30	Very Good 良好



Cold environment will reduce colostrum absorption from the gut
寒冷的环境会减少肠道对初乳的吸收





Factors influencing colostrum quality

影响初乳质量的因素

- Genetics 基因
- Individual 个体
- Nutrition 营养
- General health and immune status (vaccination)

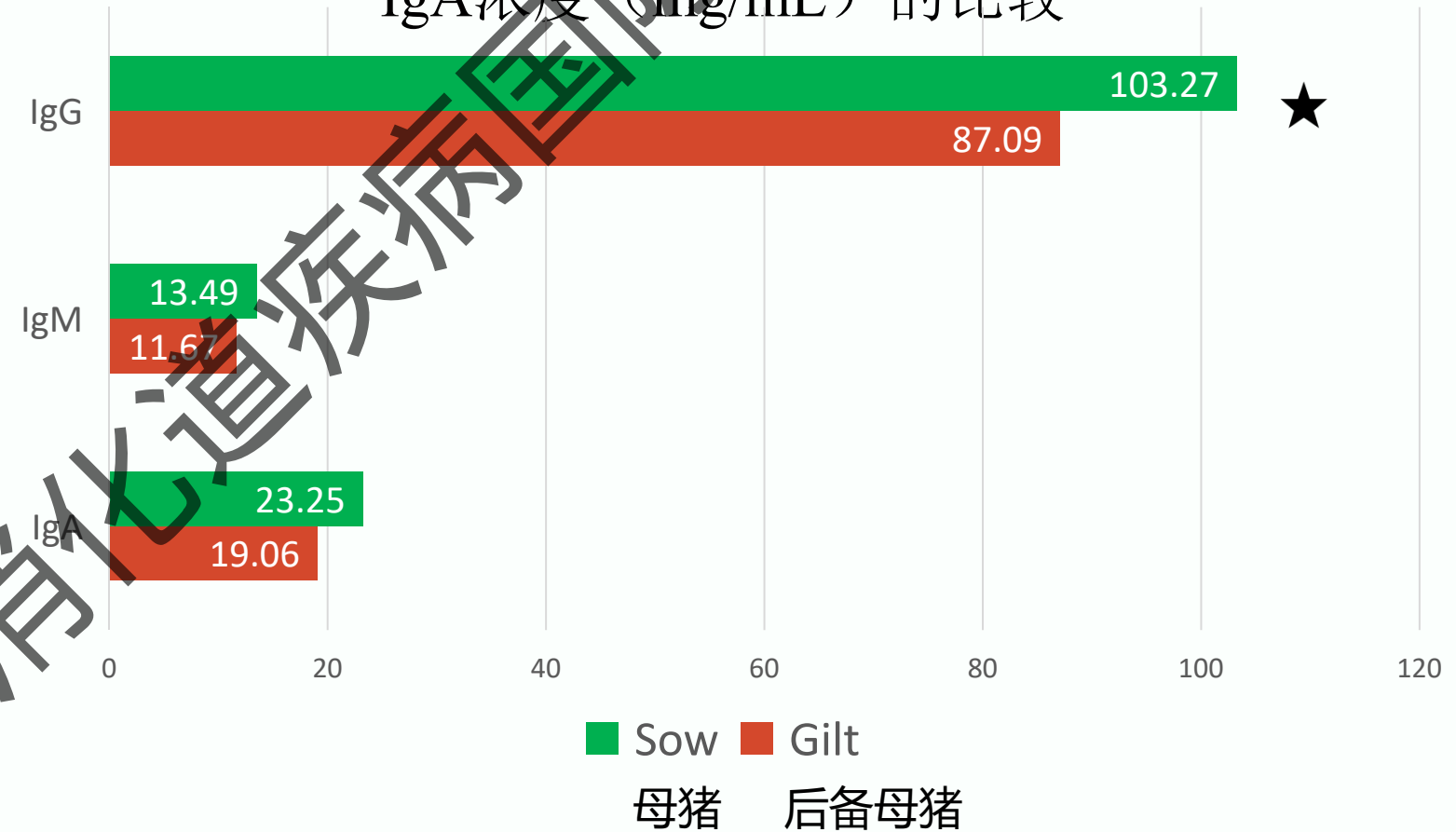
总体健康和免疫状况（疫苗接种）

- Nipple location 乳头定位
- Parity 胎次



Maciag et al (2022). Nature Scientific Reports 12(1):15630

Comparison of total IgG, IgM, and IgA concentrations (mg/mL) in colostrum from gilts and sows in the first 3 h after farrowing
后备母猪和经产母猪分娩后头3小时初乳中总IgG、IgM和IgA浓度 (mg/mL) 的比较





Factors influencing colostrum quality

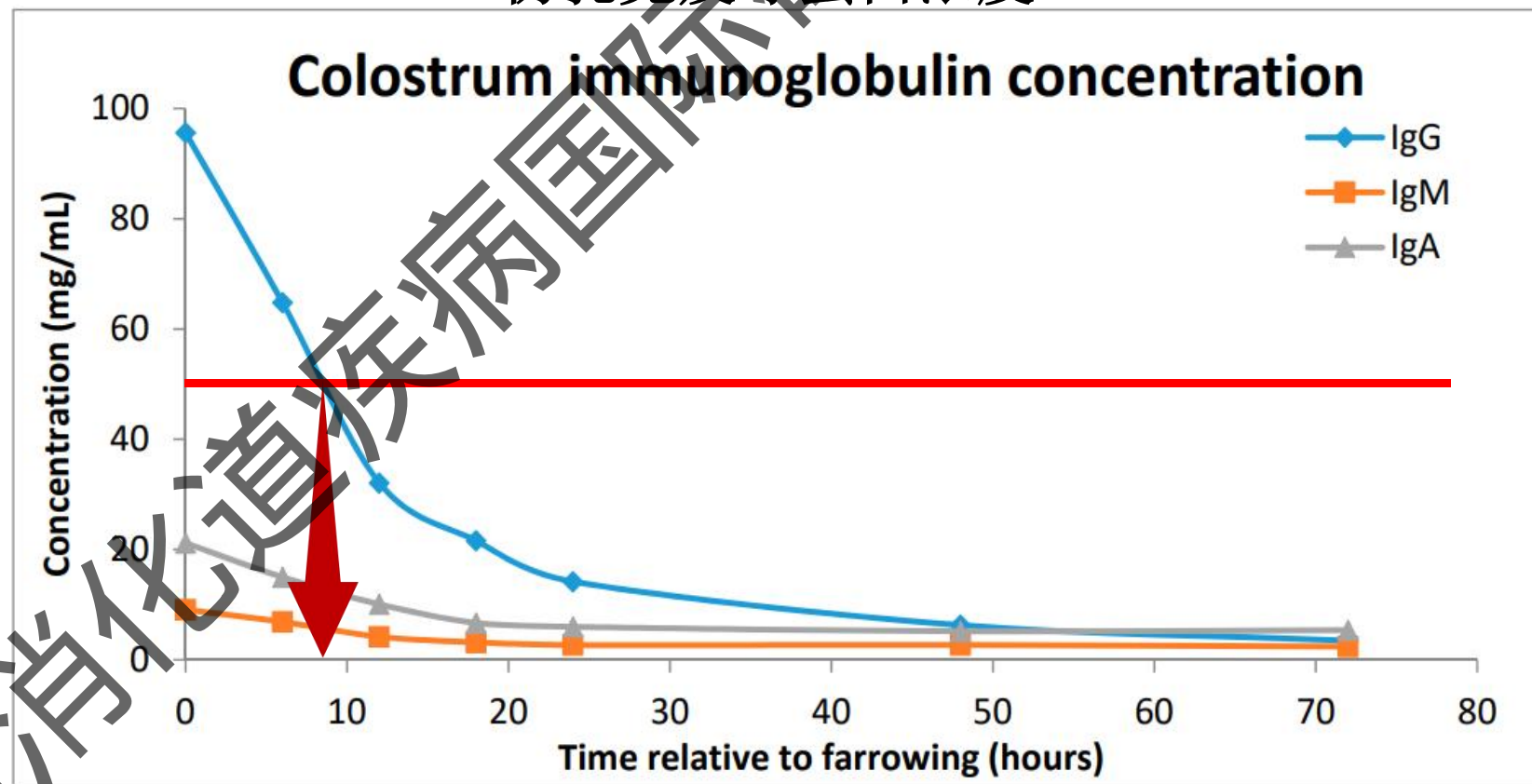
影响初乳质量的因素

- Genetics 基因
- Individual 个体
- Nutrition 营养
- General health and immune status (vaccination)
总体健康和免疫状况（疫苗接种）
- Nipple location 乳头定位
- Parity 胎次
- Time after farrowing 分娩后时间



Alexopoulos et al (2018). *Animals* 8, 38

初乳免疫球蛋白浓度



相对于分娩的时间（小时）

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Serum IgG from colostrum

初乳血清IgG

1. Quality of colostrum 初乳质量
2. Quantity of colostrum 初乳数量
3. Intake of colostrum 初乳摄入





Factors influencing colostrum quantity

影响初乳量的因素



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Factors 因素	Effect 影响
Early placement in farrowing pen 早期安置在分娩栏中	↑
Enrichment in farrowing pen 分娩栏中的富集	↑
Good body condition (but not fat) 良好的体况（但不胖）	↑
High water (clean) intake (+2,5 ltr/min) （干净）水摄入量高（+2.5 升/分钟）	↑
Inflammatory processes (mastitis) 炎症过程（乳腺炎）	↓
Reduced water intake 水摄入减少	↓
Endotoxins , reduced intestinal motility 内毒素，肠动力减弱	↓
Fever 发烧	↓
Pain (manual intervention) 疼痛（手动干预）	↓



Serum IgG from colostrum 初乳血清IgG

1. Quality of colostrum 初乳质量
2. Quantity of colostrum 初乳数量
3. Intake of colostrum 初乳摄入





Measuring intakes 测量初乳摄入量

1. Weighing piglets 仔猪称重 (Devillers et al. Animal Science 2004, 78: 305-313)

a) After birth 出生后

b) After 24h 出生后24小时

➤ CI 初乳摄入量(g/24 h) = (1.55 × 0.944 × BW gain 体重增加24 h) + 115

➤ Amdi et al. J. Anim. Sci. 2013.91:5605–5613

➤ ≥ 250g colostrum 初乳

+ 95g



Measuring intakes 测量初乳摄入量

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1. Weighing piglets 仔猪称重 (Devillers et al (2004). Animal Science 78: 305-313)
2. Serum samples (immunoglobulins) 血清样本 (免疫球蛋白)
 1. Zinc sulphate turbidity test 硫酸锌浊度试验
 2. Immunocrit 测量免疫球蛋白法 (Vallet et al. (2013). The Veterinary Journal 195: 91-97)
 3. IgG ELISA 免疫球蛋白G ELISA检测法
 4. Brix?
 1. Schoos et al (2021). Animal 15: 100041: Good indicator of IgGIgG 良好指标
 2. Fleming (2021). DVM project report: Poor indicator of piglet survivability
Fleming (2021). DVM项目报告: 仔猪生存能力指标差

Managing colostrum intakes

管理初乳摄入量

1

Bottle feeding
奶瓶饲喂

- High numbers of small and low viable piglets 大量低体重和低存活率仔猪
- Variation in piglet size 仔猪大小不一

2

Assisted suckling
辅助哺乳

- High numbers of small and low viable piglets 大量低体重和低存活率仔猪
- IUGR 宫内发育迟缓
- 800-1100 grams 克

3

Split suckling
分批哺乳

- Large litters 窝仔数量大
- Variation in piglet size 仔猪大小不一



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Common solutions to pre-wean diarrhoea 断奶前腹泻的常见解决方案

- Biosecurity (exclusion, management, containment)
生物安全（排除、管理、抑制）
- Colostrum management 初乳管理
- Neonate (environment) management
新生仔猪（环境）管理
- Sow nutrition 母猪营养
- Vaccination 免疫接种

1. Clean 清洁
2. Dry 干燥
3. Warm 温暖

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Summary总结

- **Colostrum is the elixir of life** 初乳对仔猪十分关键
- Manage the **sow** so her colostrum yield and quality are optimised (this starts during her first pregnancy)
- 管理母猪，使其初乳产量和质量得到优化（从后备母猪第一次怀孕时开始）
- Manage the **neonates** and their **environment** to maximise colostrum intake and ability to fully absorb the immunoglobulins
- 管理新生仔猪及其环境，最大限度地提高初乳的摄入量 and 充分吸收免疫球蛋白的能力

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