# Cereais, leguminosas e tubérculos: quais as diferenças entre estes amidos?





Prof. Ananda P. Félix

Universidade Federal do Paraná

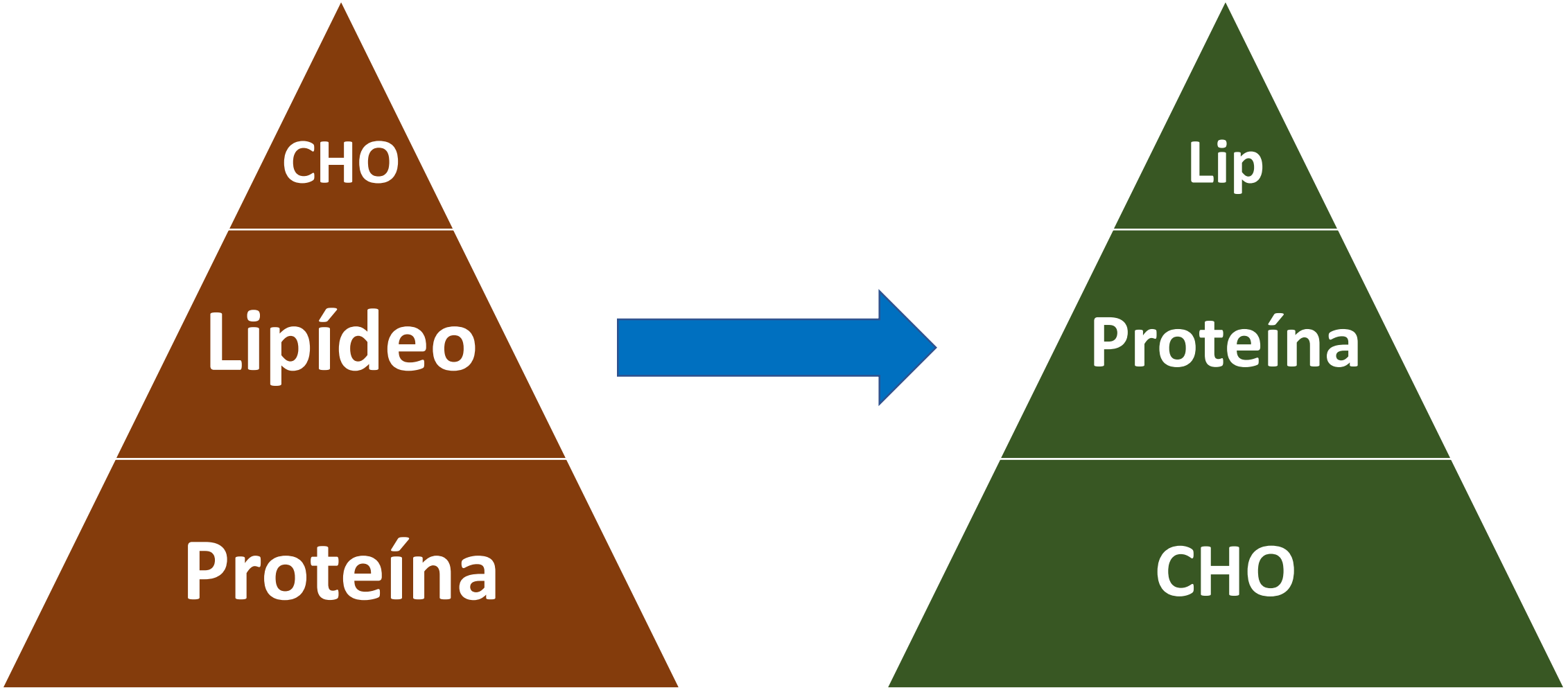
# Sumário

- Conceitos gerais
- Fontes de amido
- Estrutura do amido
- Amido x processo
- Efeitos sobre digestibilidade, palatabilidade e glicemia
- Implicações








CHO
Lipídeo
Proteína
Lip
Proteína
CHO




Neolítico (11500-6000 anos)

MENU

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Letter

# The genomic signature of dog domestication reveals adaptation to a starch-rich diet

Erik Axelsson, Abhirami Ratnakumar, Maja-Louise Arendt, Khurram Maqbool, Matthew T. Webster, Michele Perloski, Olof Liberg, Jon M. Arnemo, Åke Hedhammar & Kerstin Lindblad-Toh

*Nature* **495**, 360–364 (21 March 2013)
doi:10.1038/nature11837
Download Citation

Evolutionary genetics | Genomics | Metabolism | Population genetics

Received: 01 July 2012
Accepted: 11 December 2012
Published: 23 January 2013

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Research

**Cite this article:** Ollivier M *et al*. 2016 *Amy2B* copy number variation reveals starch diet adaptations in ancient European dogs. *R. Soc. open sci.* **3**: 160449.
http://dx.doi.org/10.1098/rsos.160449

# *Amy2B* copy number variation reveals starch diet adaptations in ancient European dogs

Morgane Ollivier[1,2], Anne Tresset[3], Fabiola Bastian[1,2], Laetitia Lagoutte[4], Erik Axelsson[5], Maja-Louise Arendt[5], Adrian Bălăşescu[6], Marjan Marshour[3], Mikhail V. Sablin[7], Laure Salanova[8], Jean-Denis Vigne[3], Christophe Hitte[4] and Catherine Hänni[1,2]

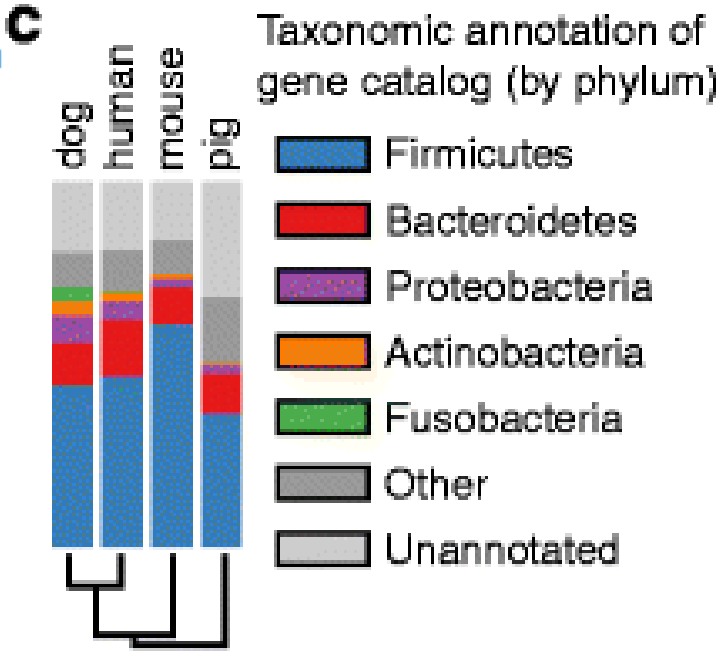
Coelho *et al. Microbiome* (2018) 6:72
https://doi.org/10.1186/s40168-018-0450-3

Microbiome

RESEARCH Open Access

# Similarity of the dog and human gut microbiomes in gene content and response to diet

Luis Pedro Coelho[1], Jens Roat Kultima[1], Paul Igor Costea[1], Coralie Fournier[3], Yuanlong Pan[2], Gail Czarnecki-Maulden[2], Matthew Robert Hayward[1], Sofia K. Forslund[1], Thomas Sebastian Benedikt Schmidt[1], Patrick Descombes[3], Janet R. Jackson[2], Qinghong Li[2*†] and Peer Bork[1,4,5*†]



?





# Fontes



# Cereais
(60-88% amido)





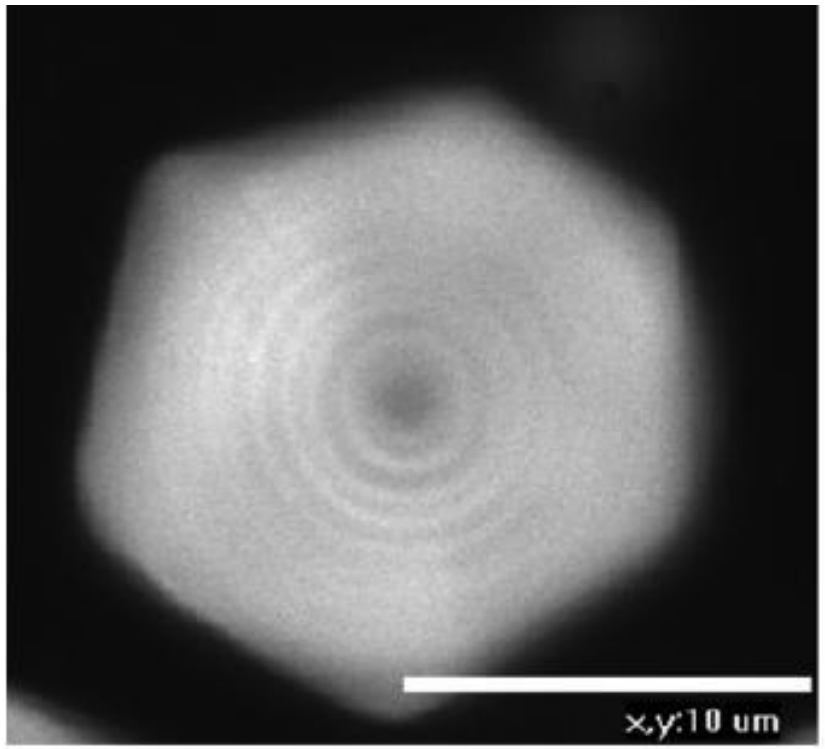
# Leguminosas
(20-60% amido)



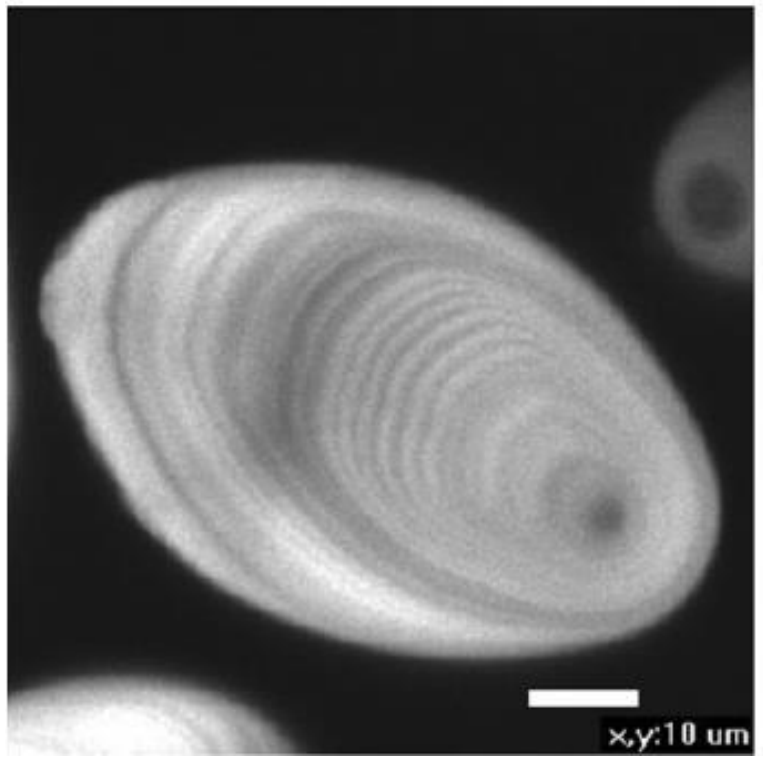
# Tubérculos
(70-90% amido)



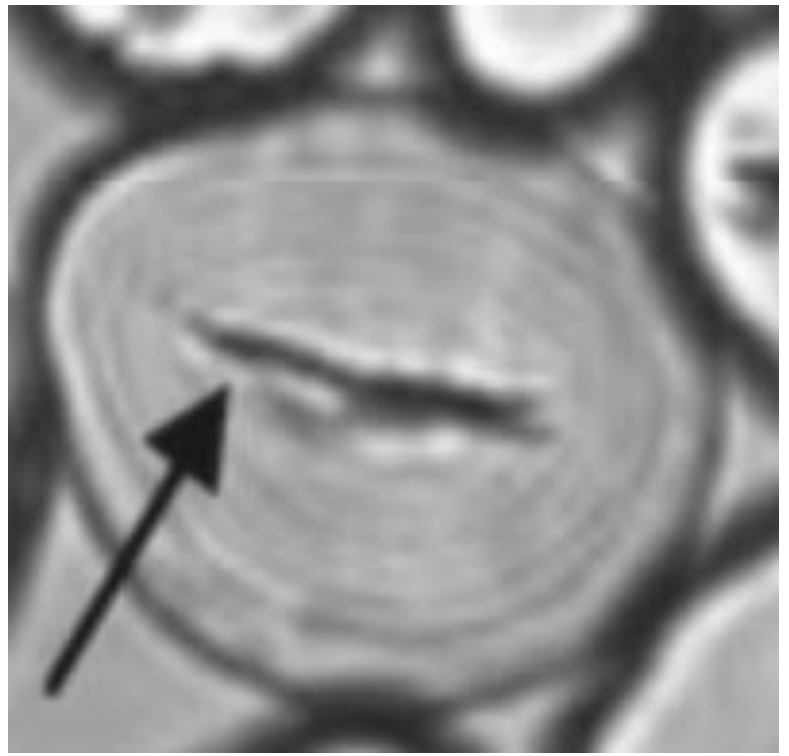
# Estrutura do amido




**Milho**



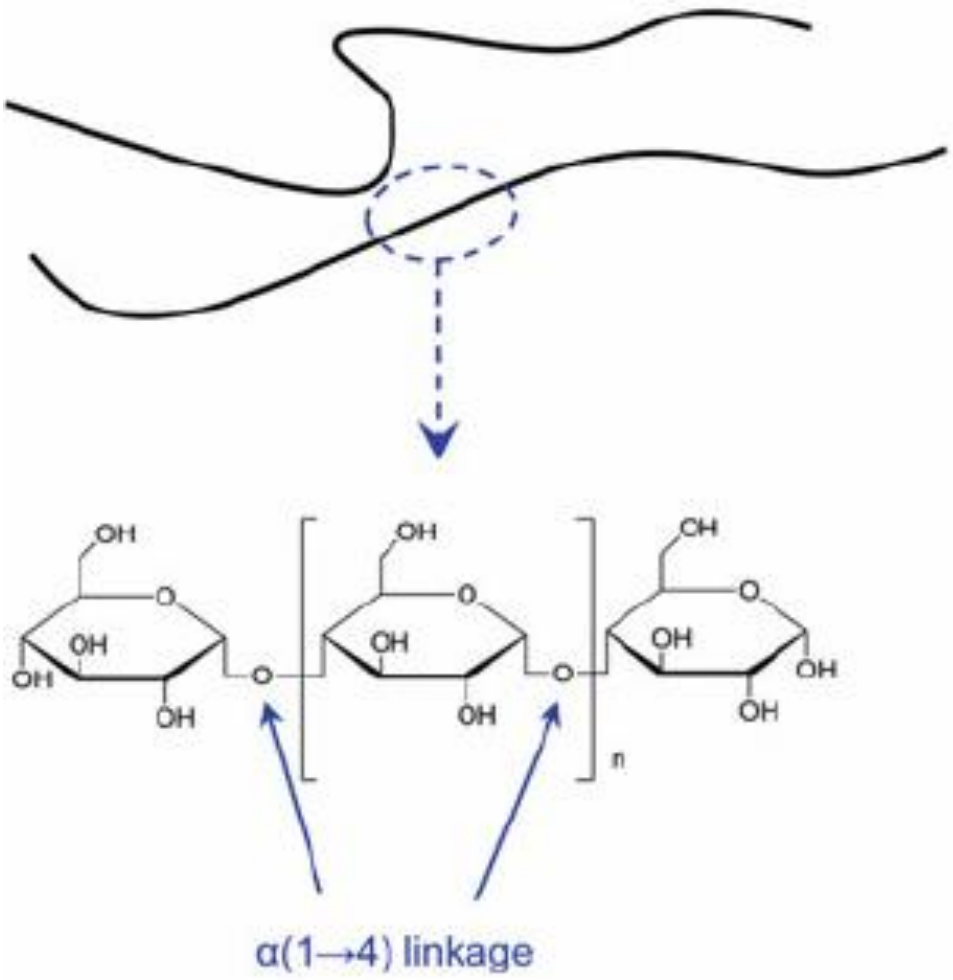

**Batata**



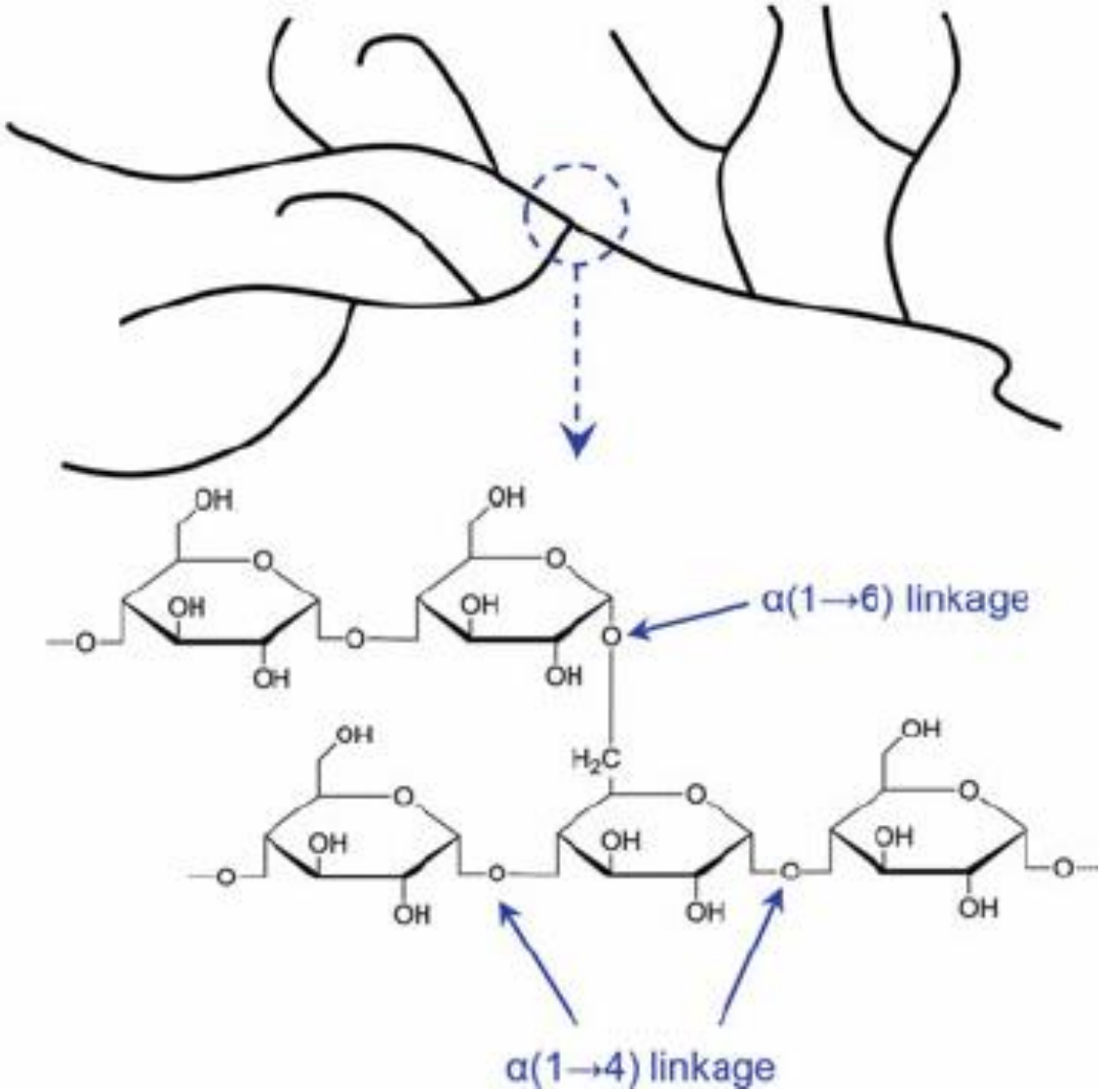
**Lentilha**

Joshi et al. (2013), Schirmer et al. (2013)

# Amilose

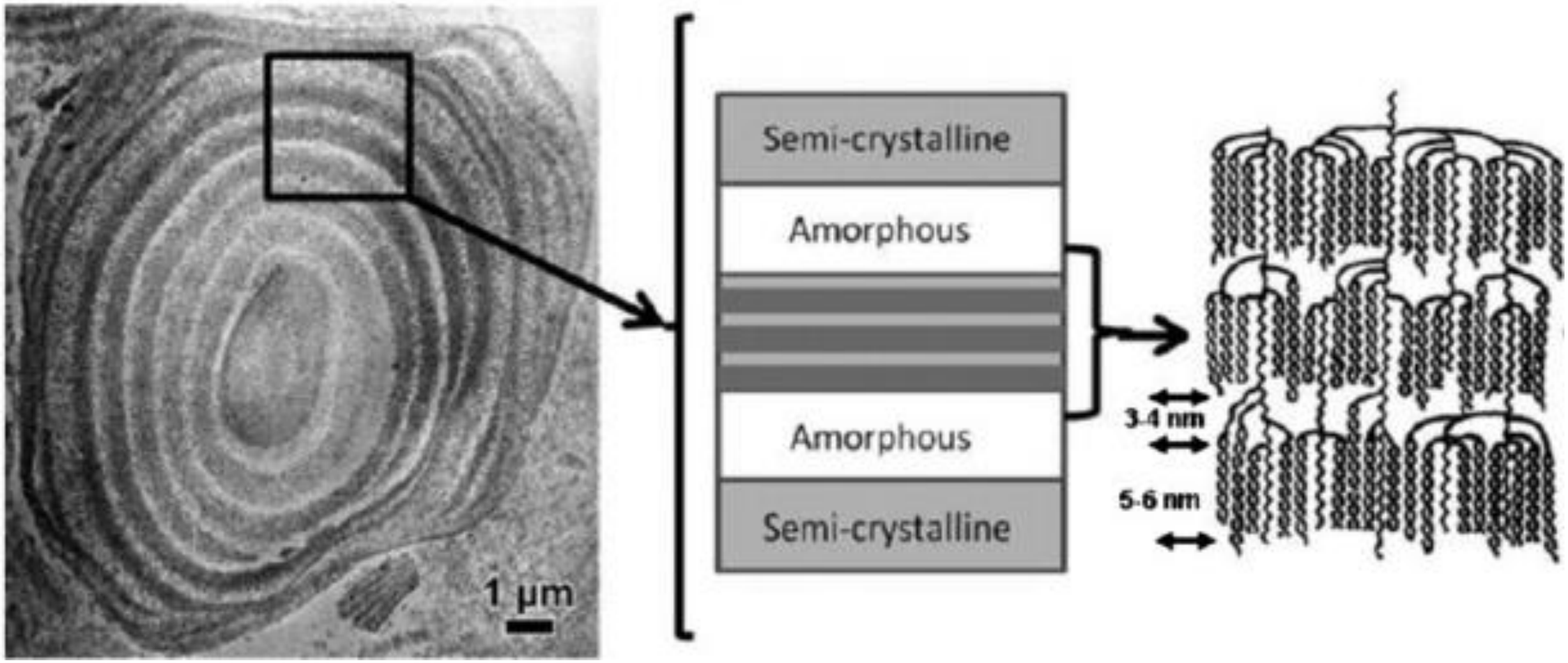



# Amilopectina



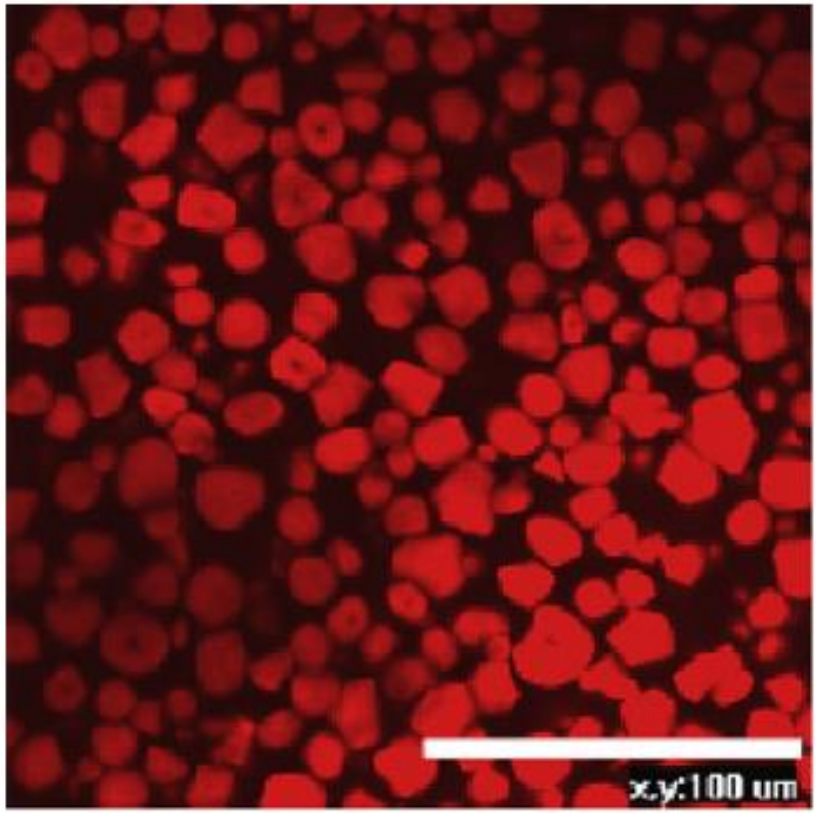

https://www.researchgate.net/publication/274961277_Advanced_nano-biocomposites_based_on_starch/figures?lo=1

# Estrutura do amido

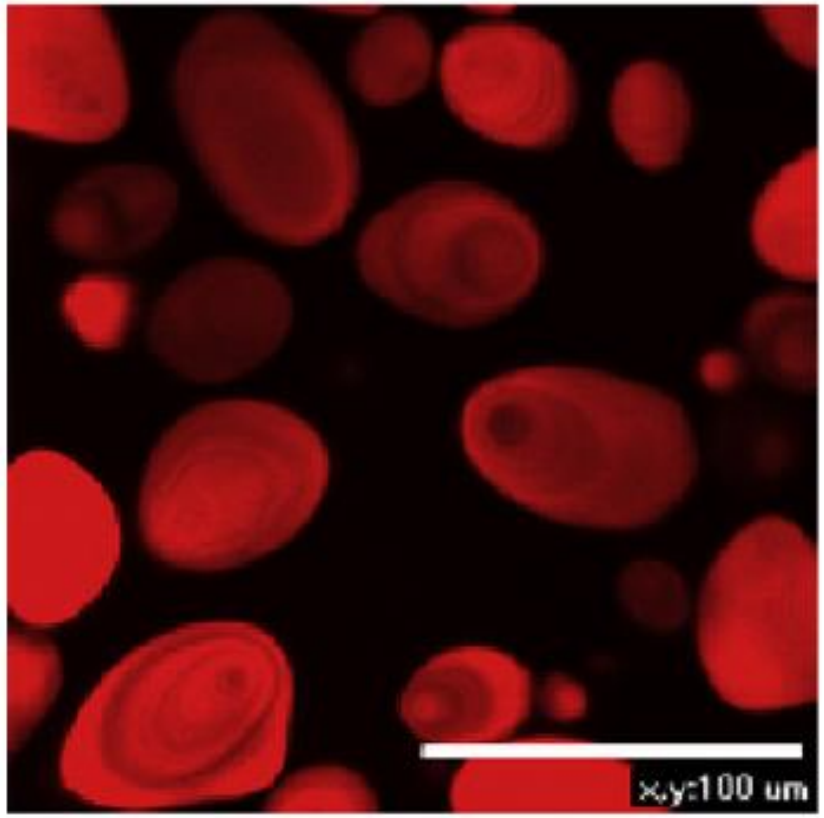



Adaptado de Perez e Bertoft (2010)

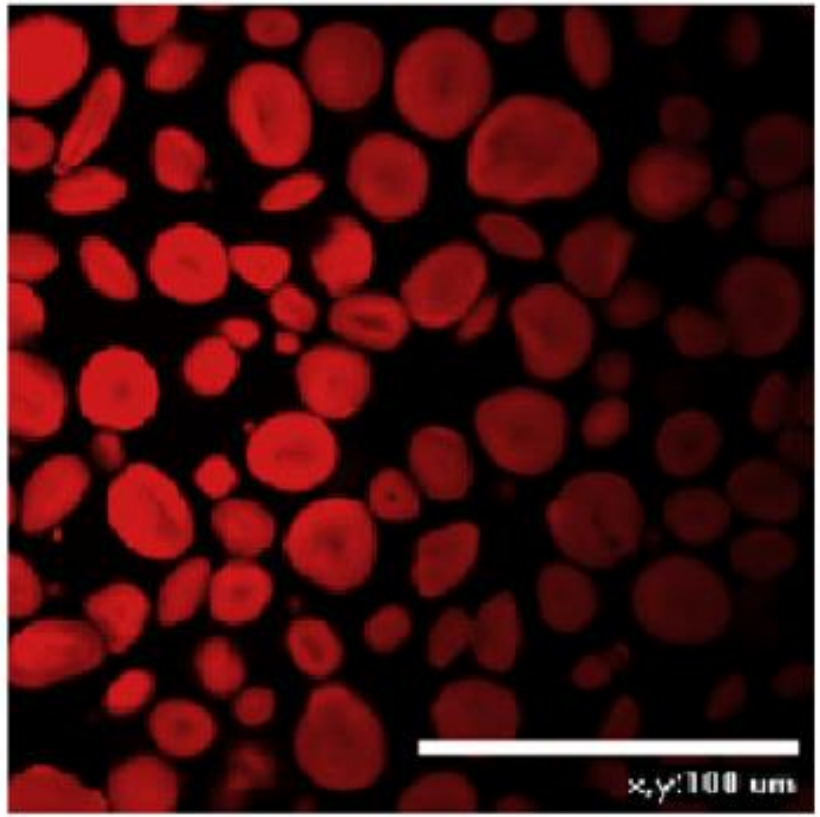
# Estrutura do amido




**Milho (106 µm²)**

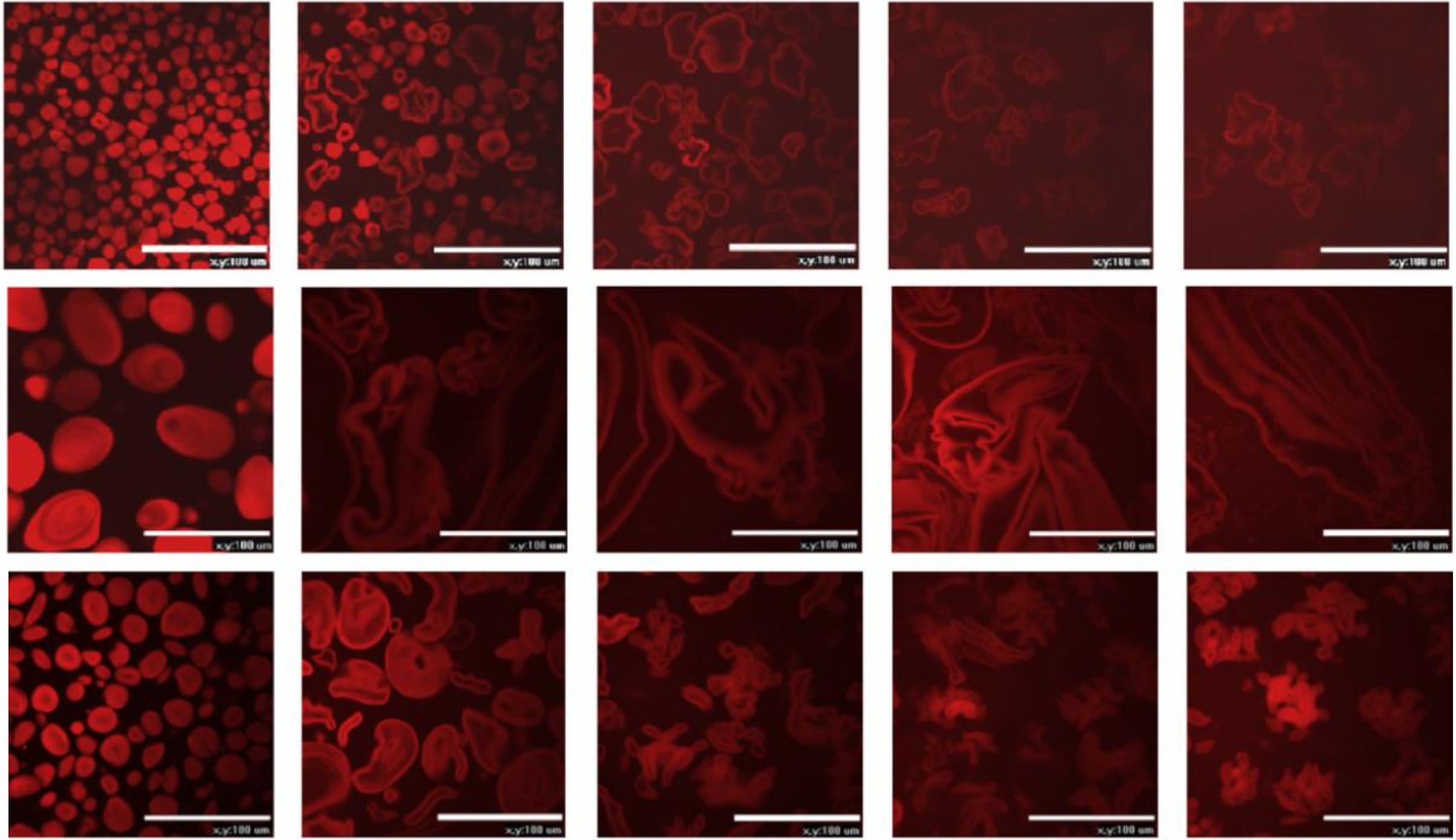



**Batata (738 µm²)**

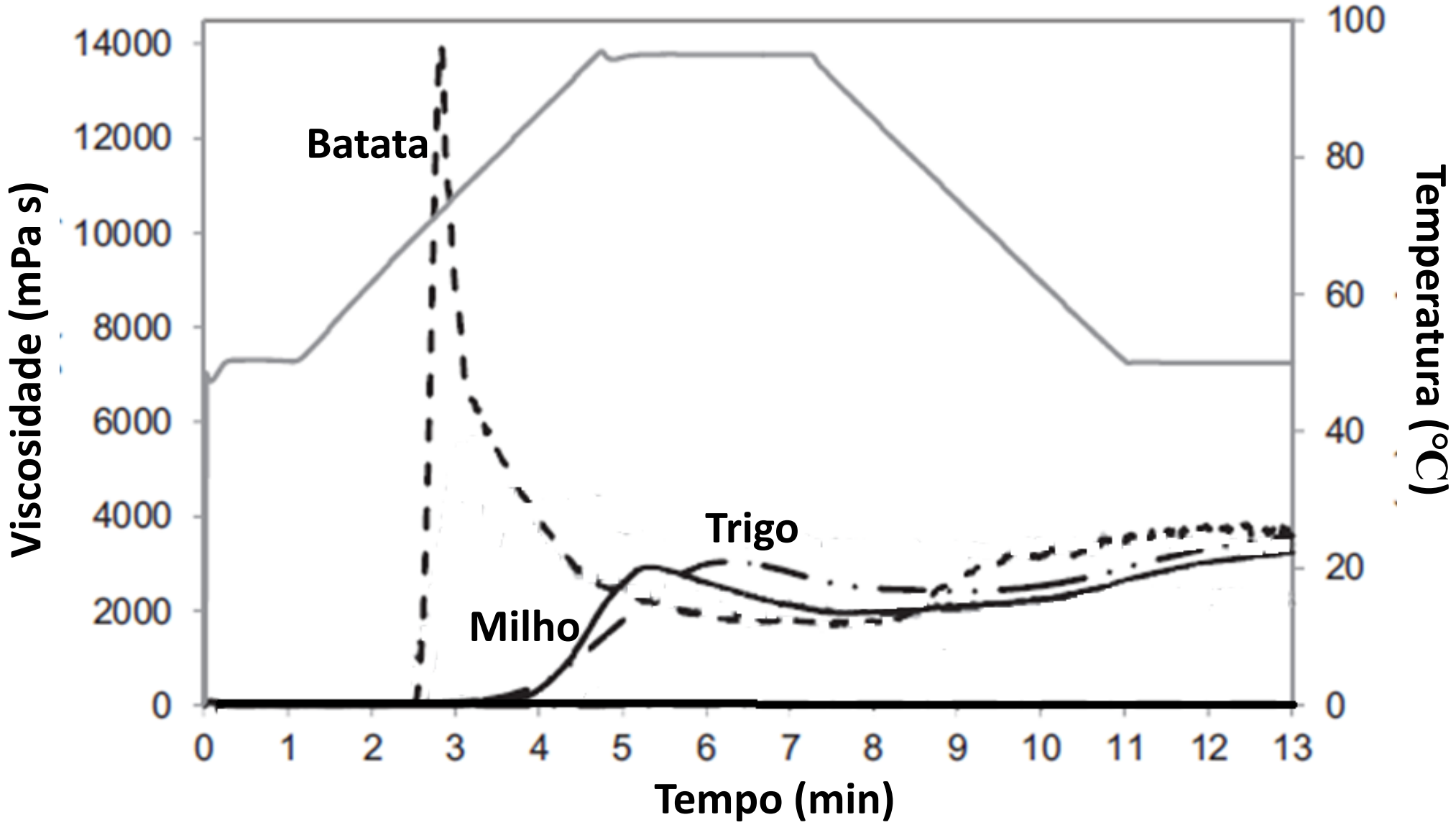



**Trigo (224 µm²)**

Schirmer et al. (2013)

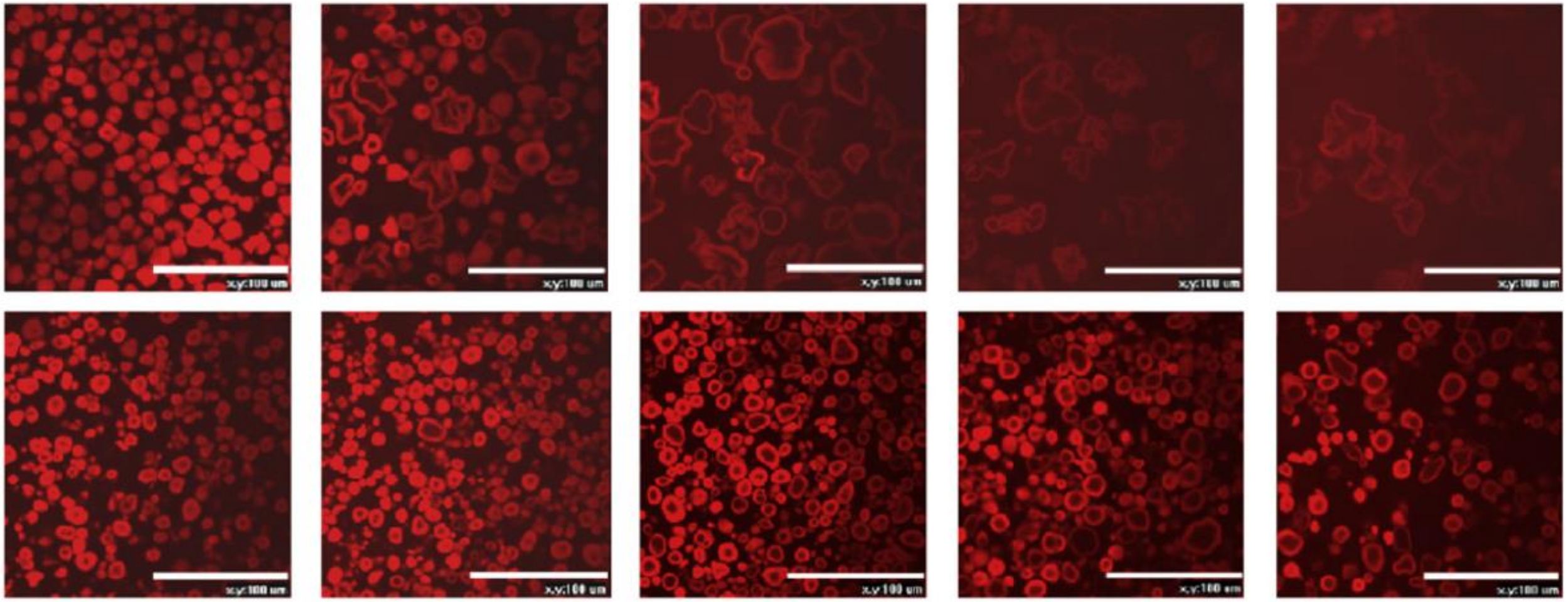


Schirmer et al. (2013)



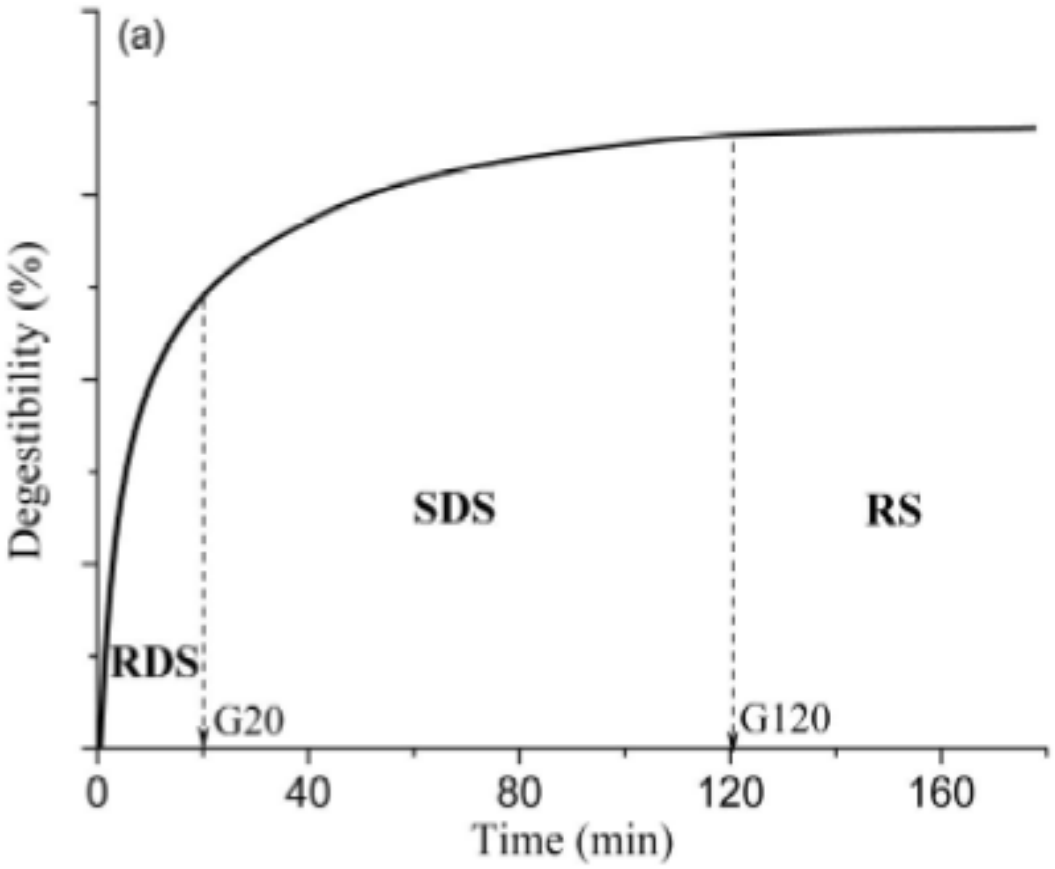

Adaptado de Schirmer et al. (2013)

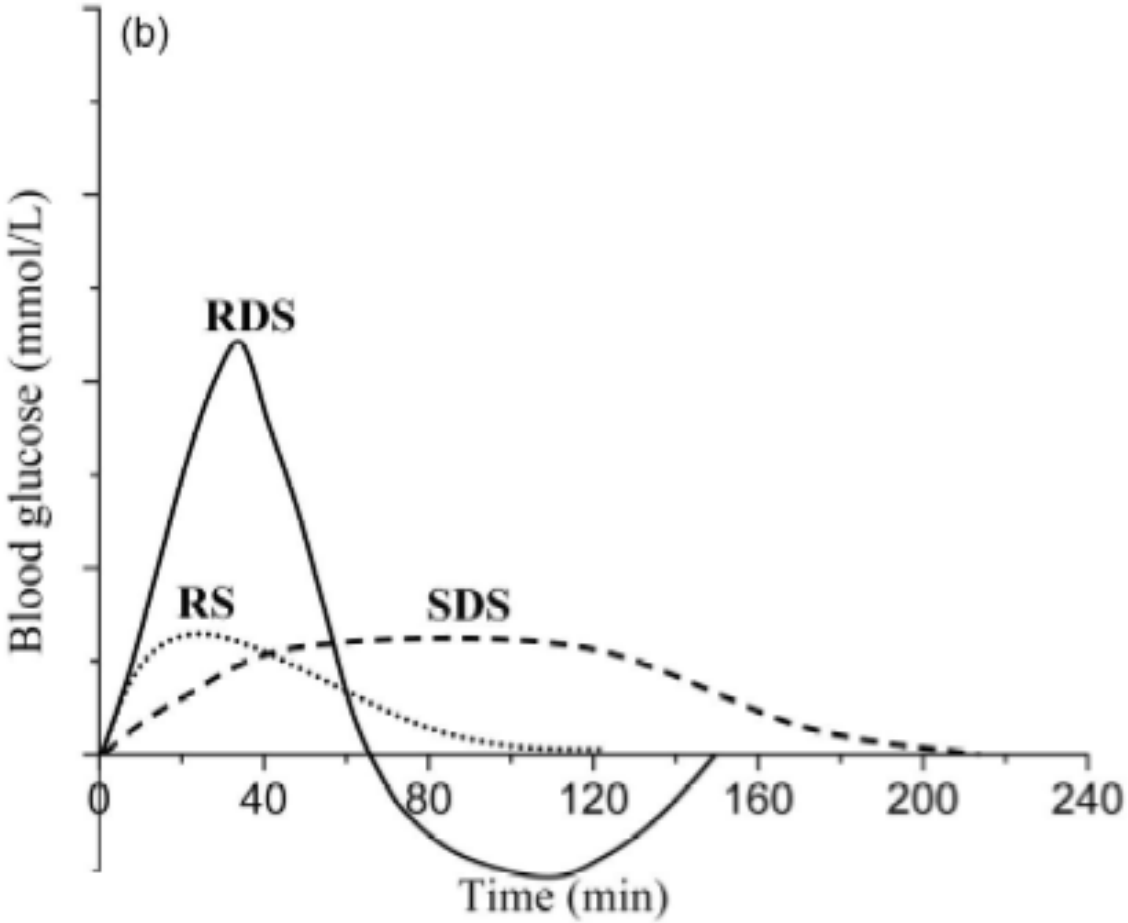
# Milho convencional x alta amilose



Schirmer et al. (2013)

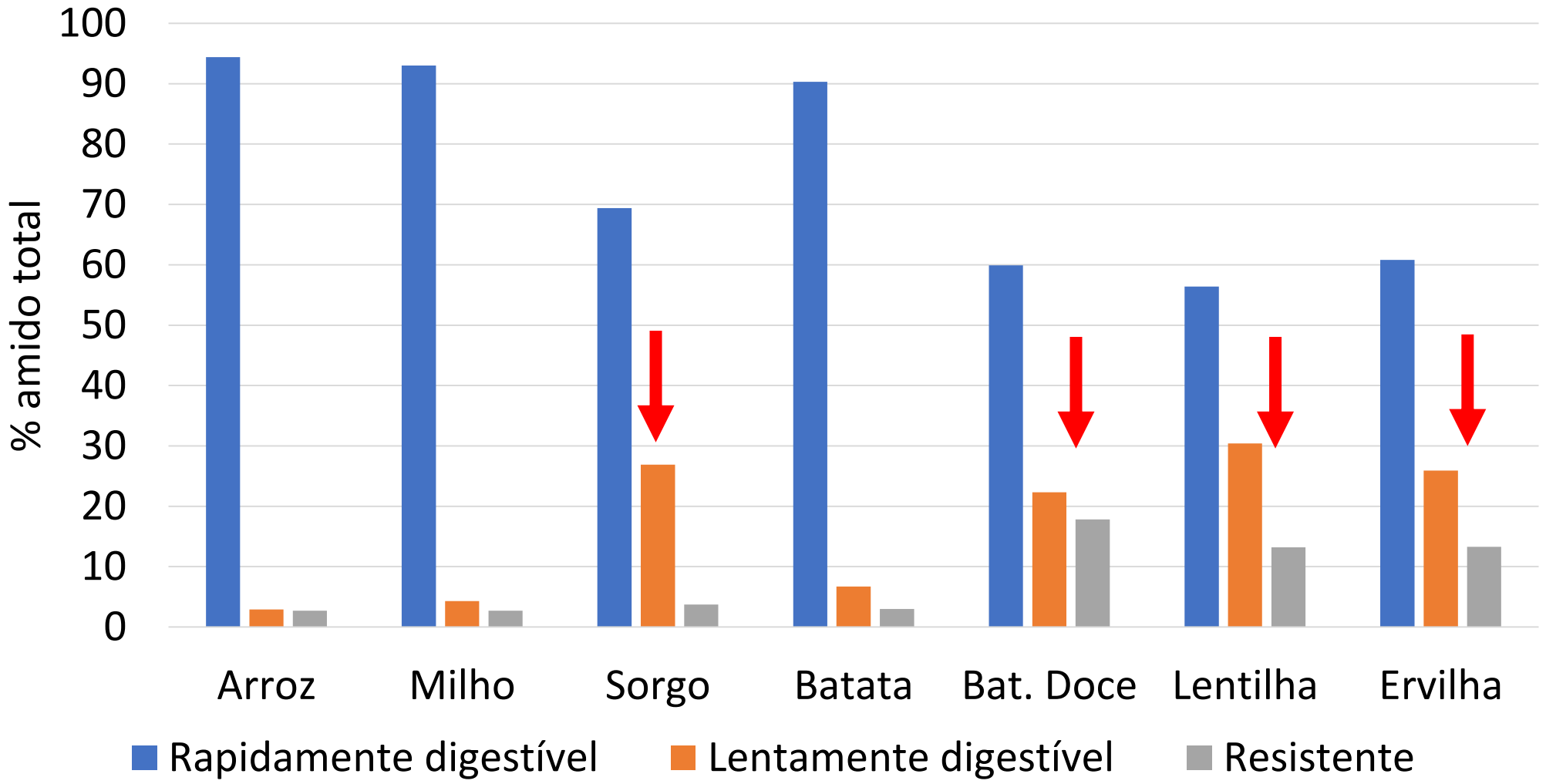
# Classificação do amido



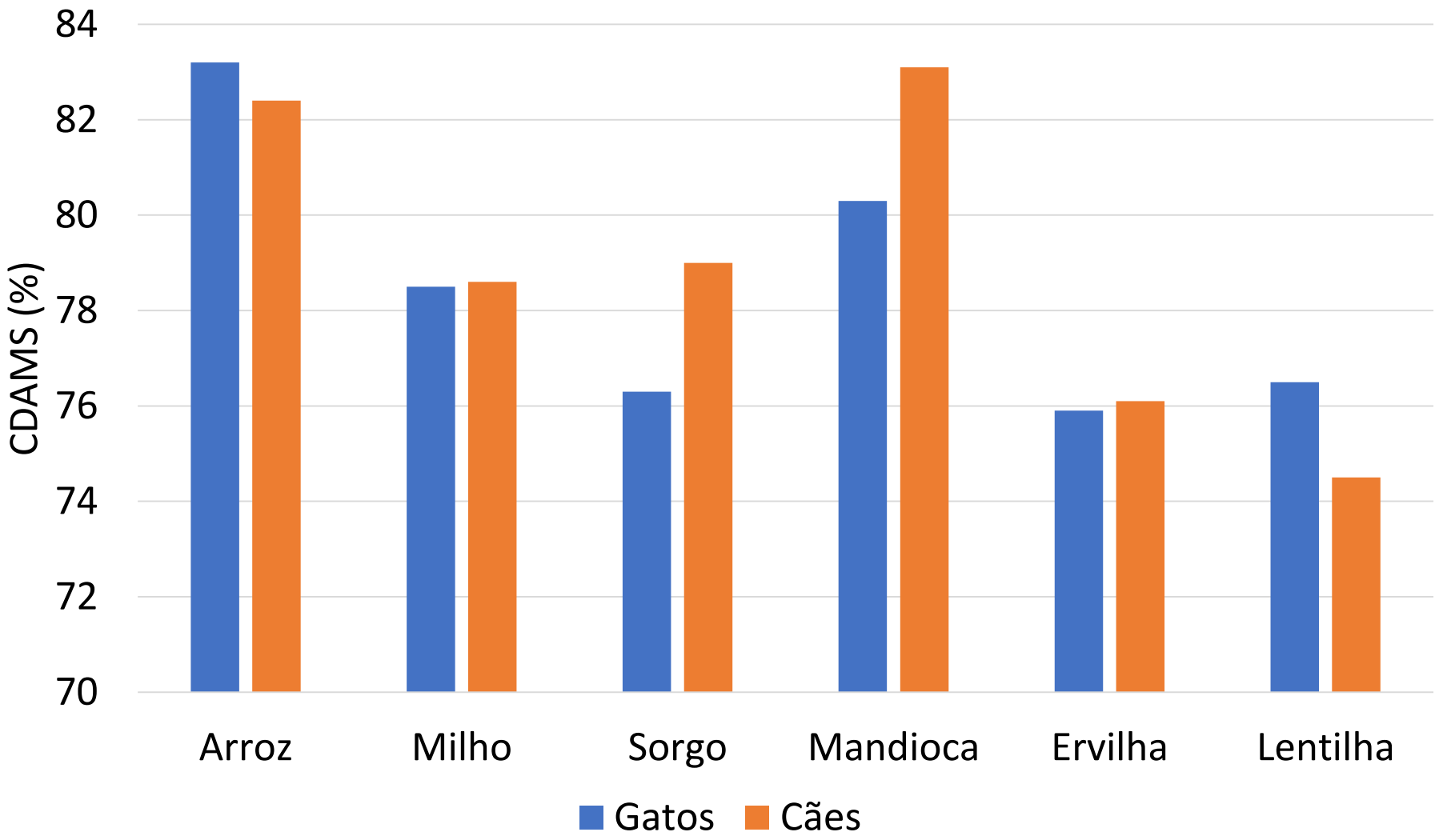

Adaptado de Englyst et al. (1992), Miao et al. (2013)

# Frações do amido após cozimento

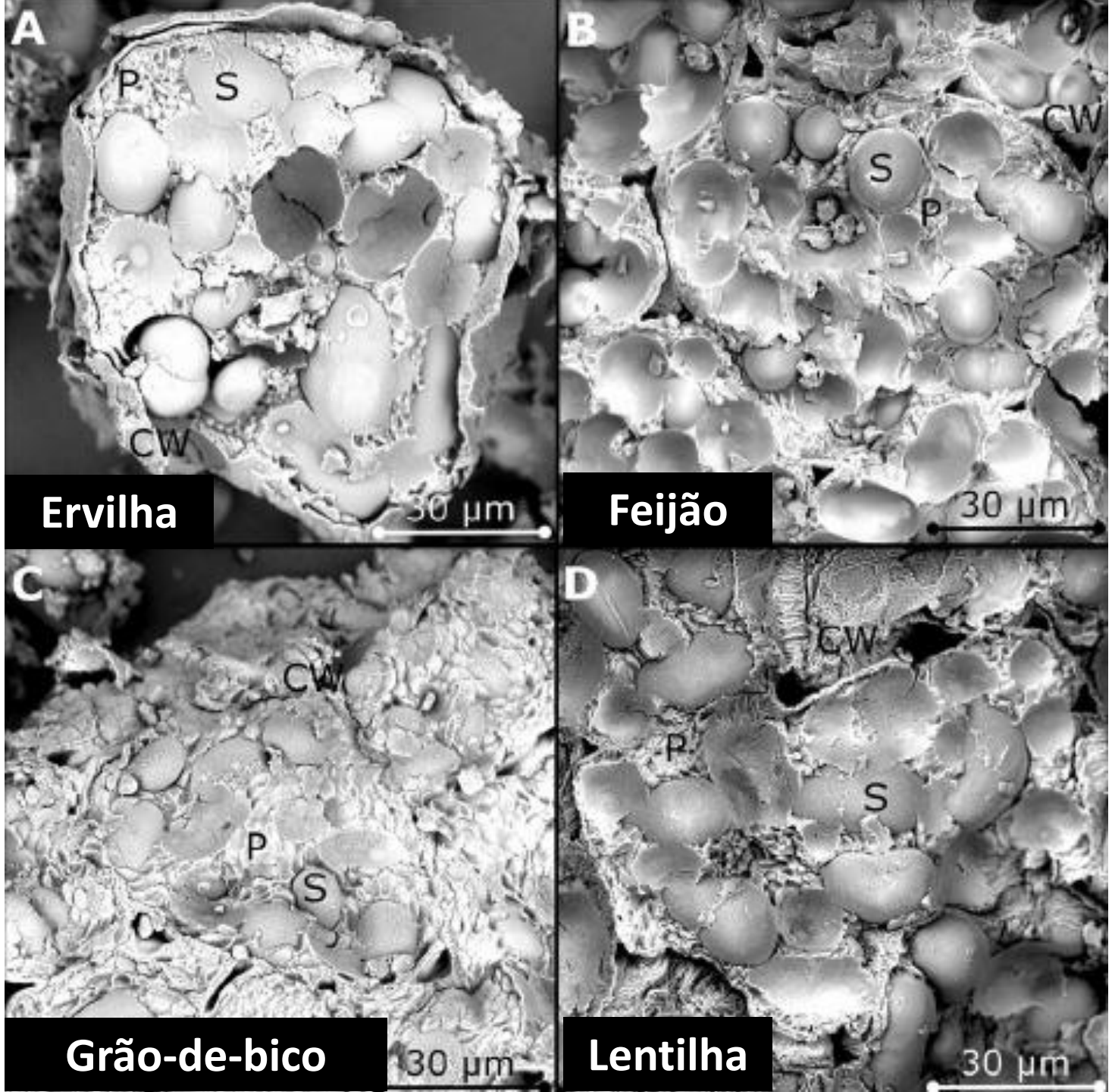



Murray et al. (2001), Shin et al. (2005), Chung et al. (2009)

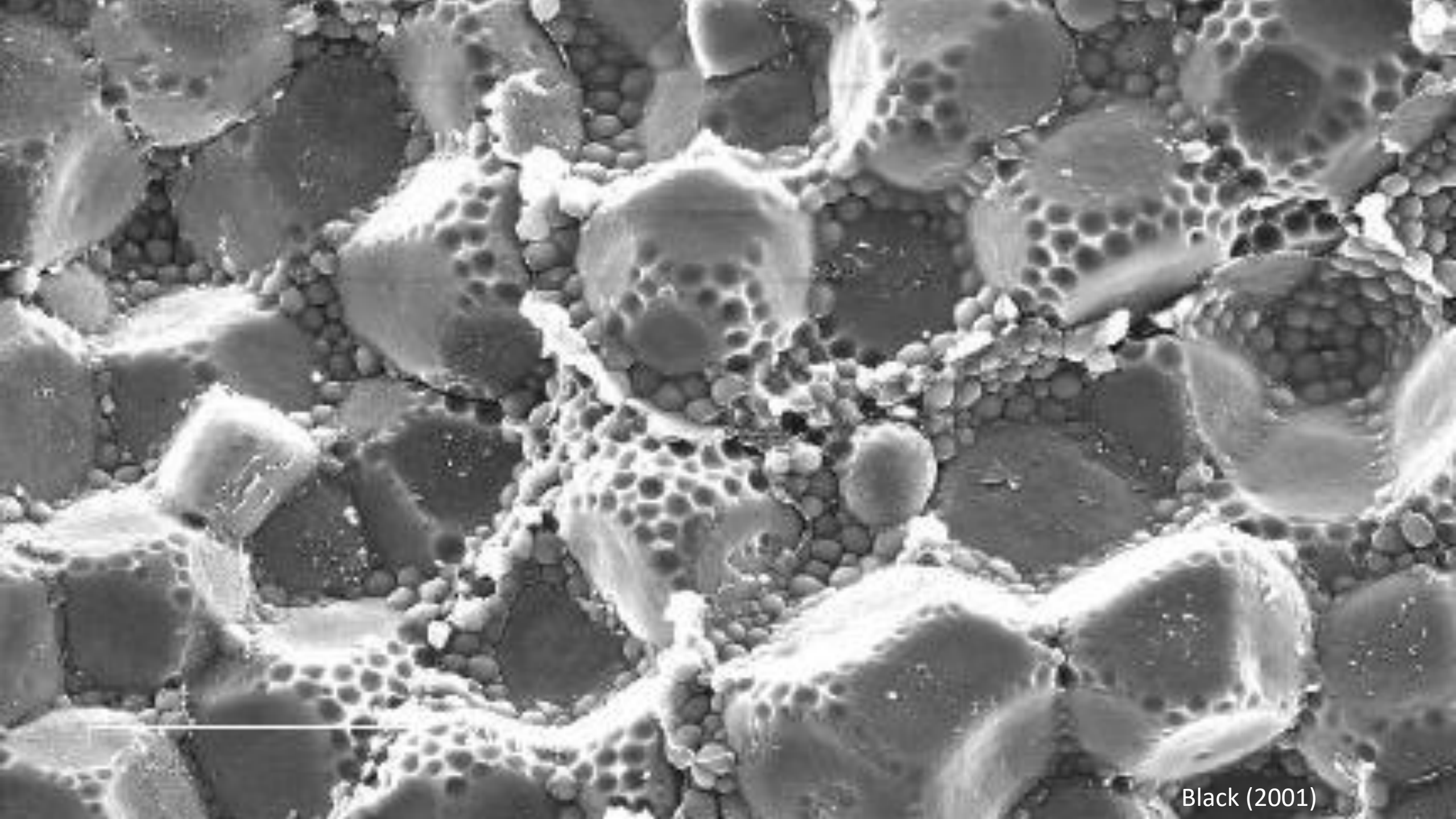
# Digestibilidade – cães e gatos




De-Oliveira et al. (2008), Carciofi et al. (2013)

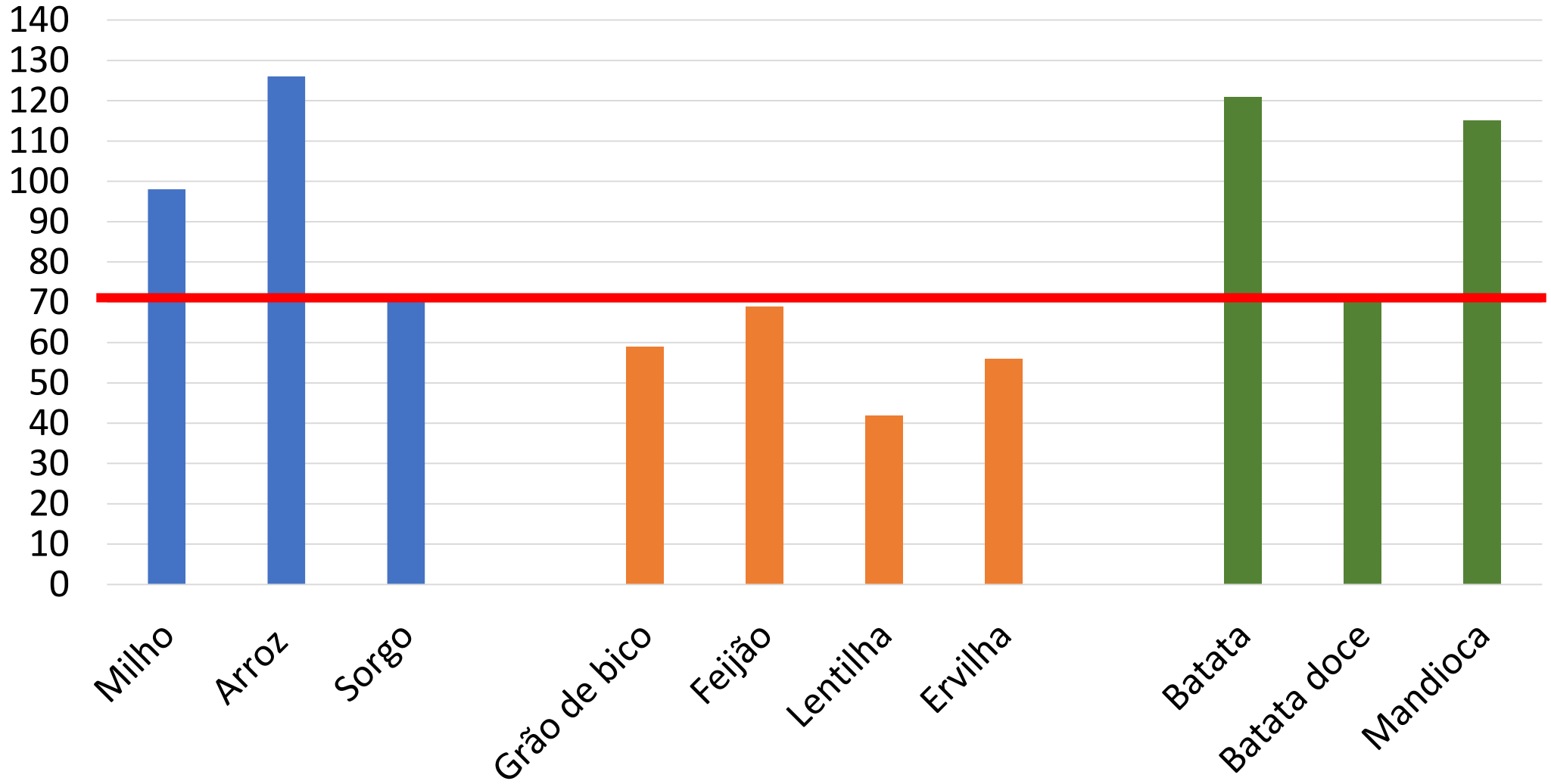



Pelgron et al. (2015)



Black (2001)

# Índice glicêmico - humanos




Adaptado de Fao (1998), Wolter et al. (2013)



**Estrutura**

- Amilose/amilopectina
- Tamanho e peso
- Comprimento Amilop

**Nutrientes**

- Prot, fibras e lipídeos
- Fatores antinutr.
- Grupos fosfatos

**Processo**

- Moagem
- Extrusão
- Armazenamento

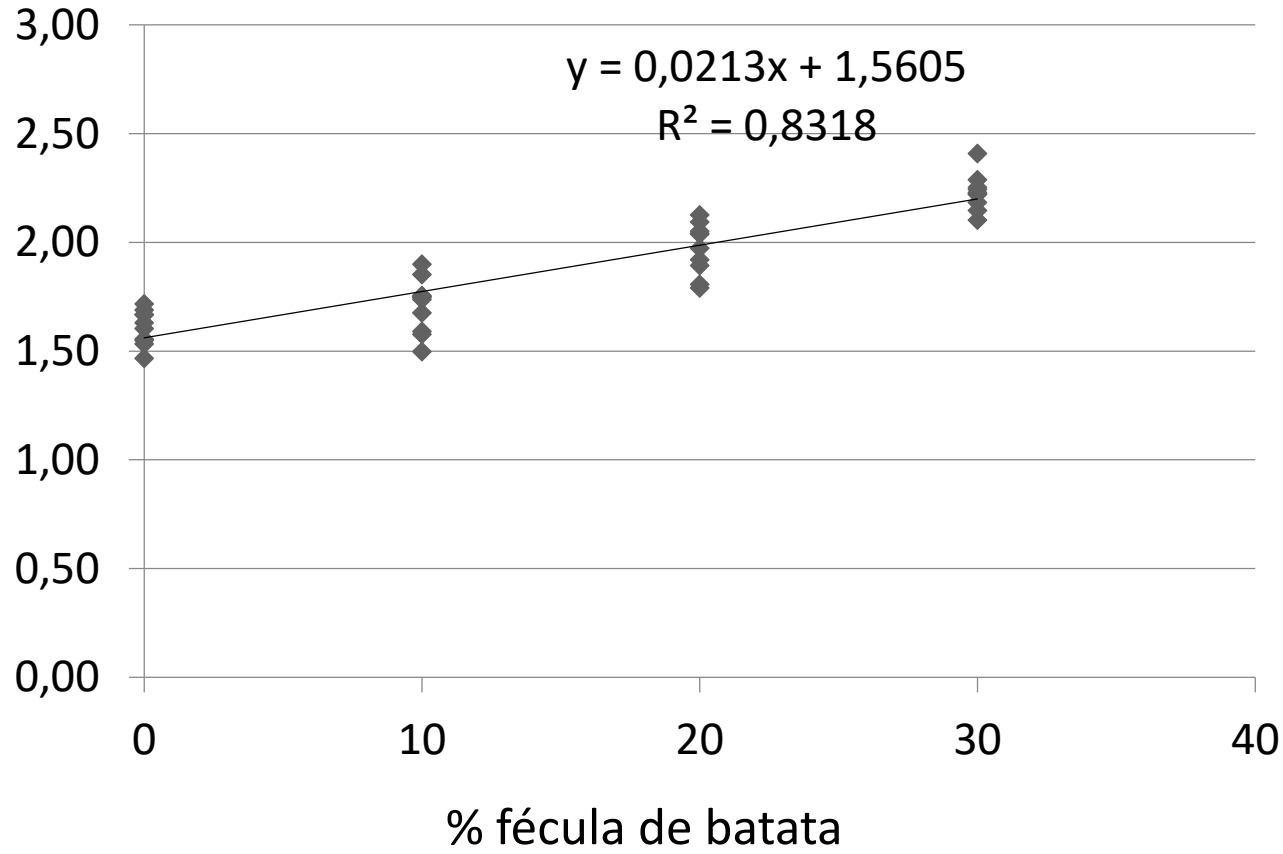
# Fécula de batata em substituição ao milho

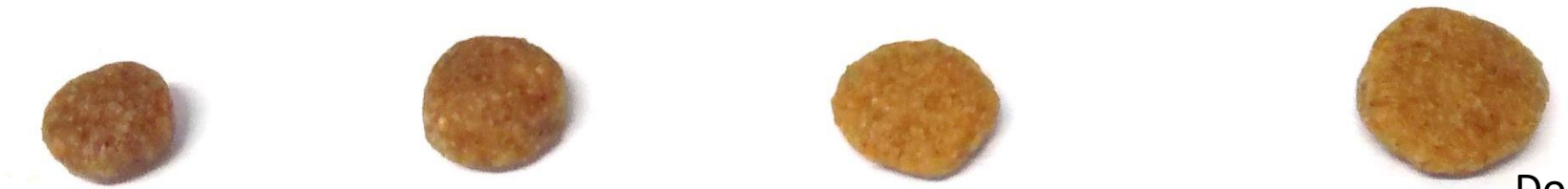
**35% PB e 5 a 3,8% AR**

| | Fécula de batata | | | |
|---|---|---|---|---|
| Item | 0% | 10% | 20% | 30% |
| CONDICIONADOR | | | | |
| Temperatura (°C) | 100 | 98,6 | 95 | 85 |
| Adição de água (L/h) | 320 | 320 | 290 | 225 |
| EXTRUSORA | | | | |
| Temperatura do canhão (°C) | 75 | 78 | 89,4 | 100 |
| EME (kw/ h/ ton) | 9,71 | 9,83 | 12,87 | 15,57 |

Domingues et al. (2016)

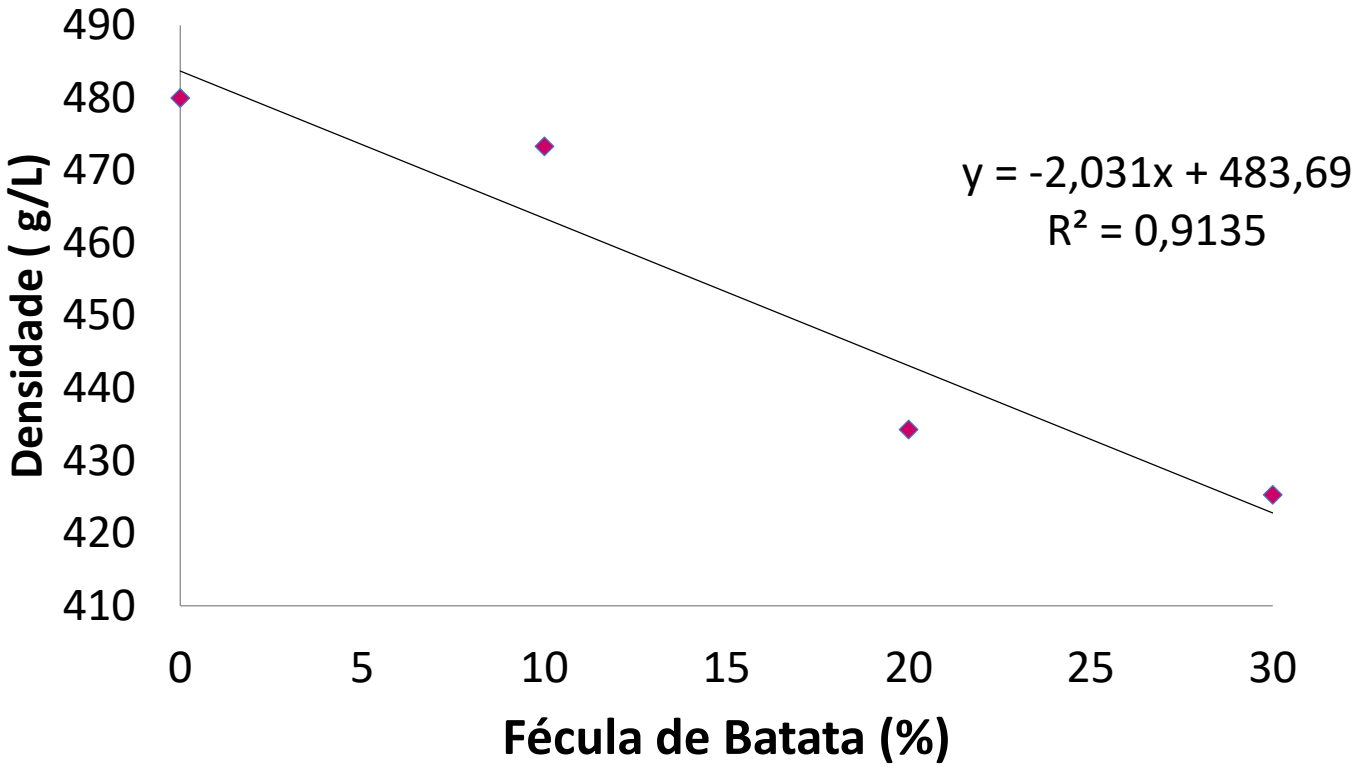
# Índice de expansão

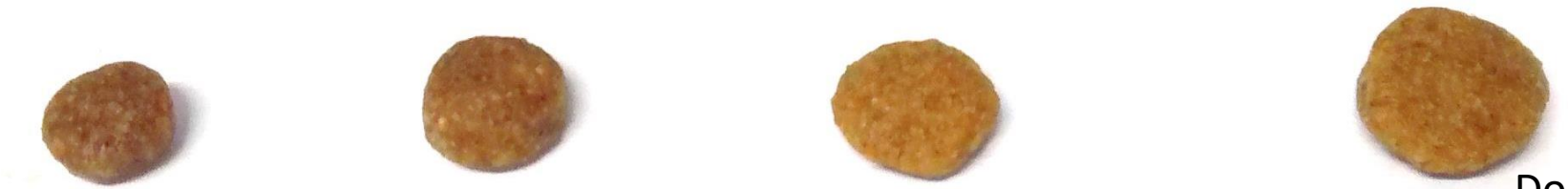


Domingues et al. (2016)

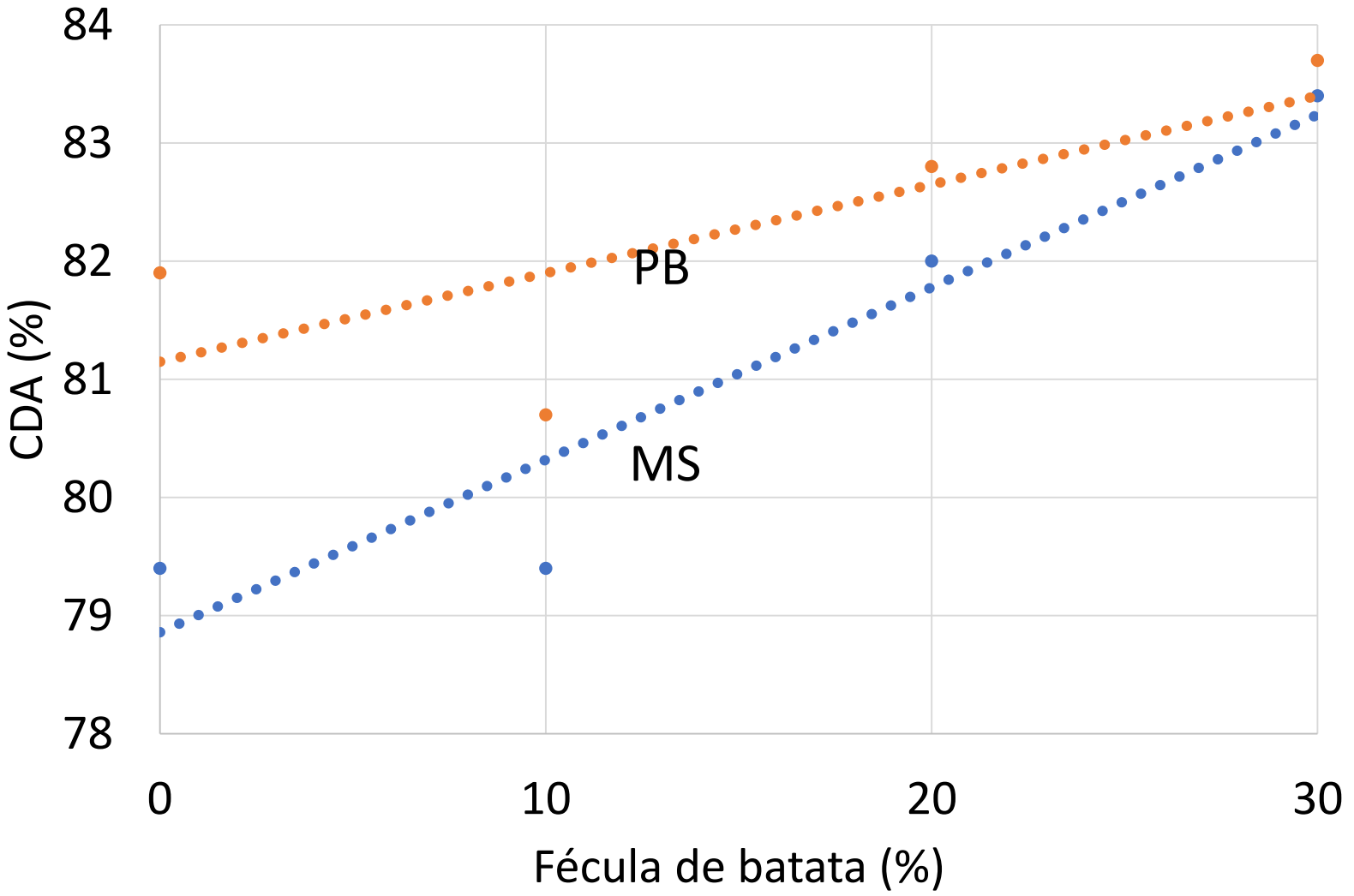
# Densidade



Domingues et al. (2016)

# Digestibilidade



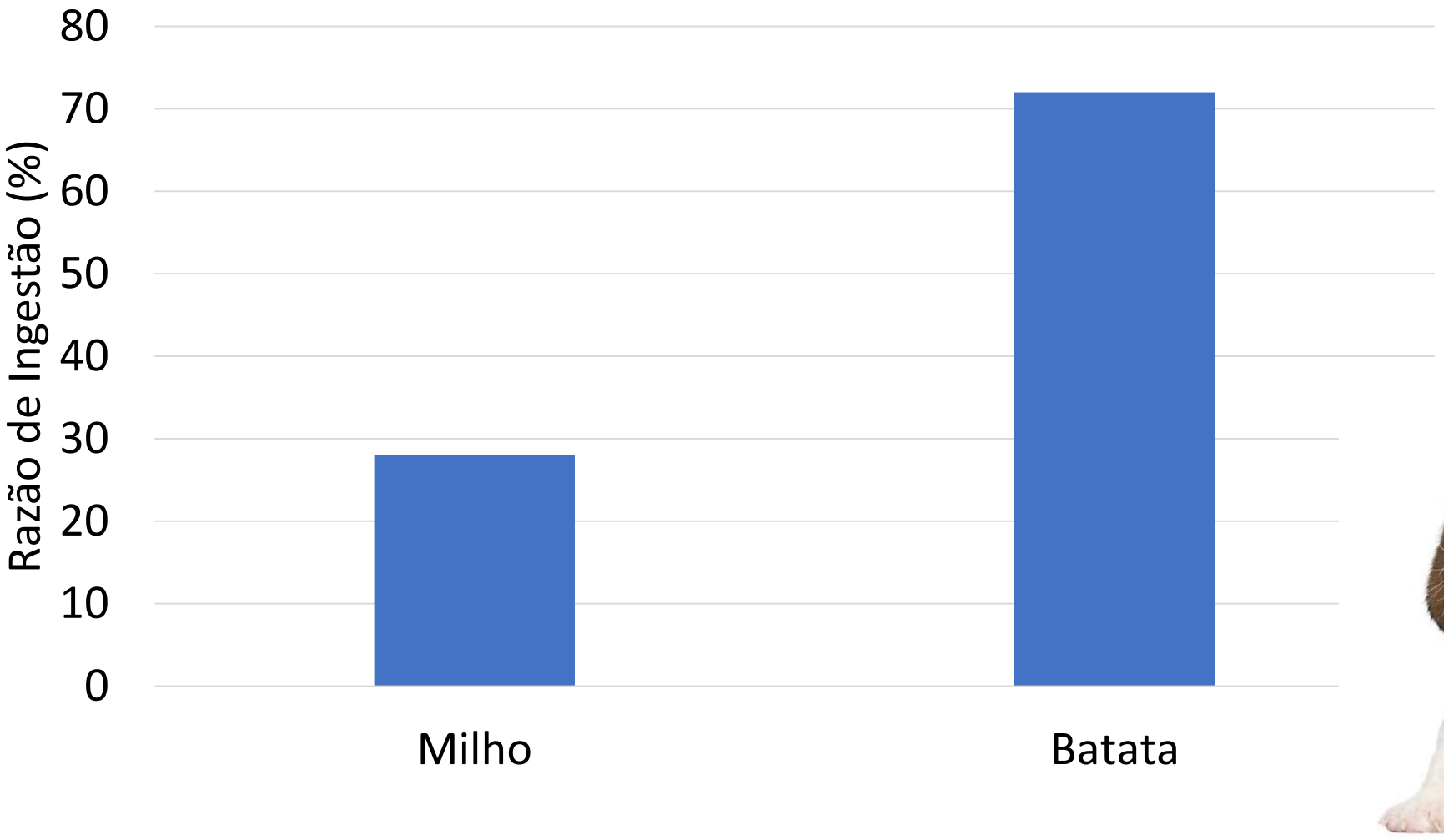

↓ amônia (0,17-0,10%)

↑ MS fecal (30,7-32,8%)



Domingues et al. (2016)

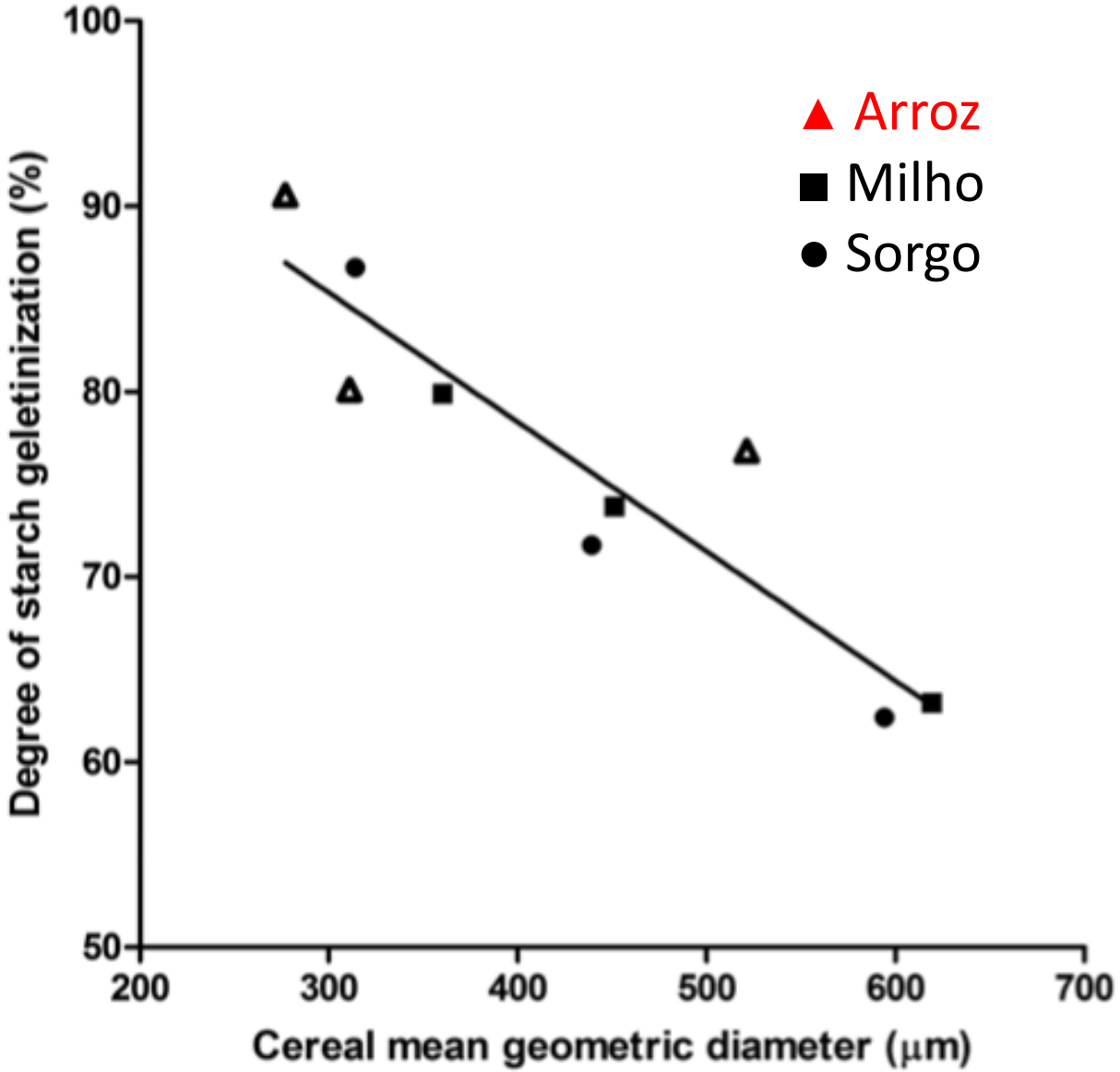
# Palatabilidade





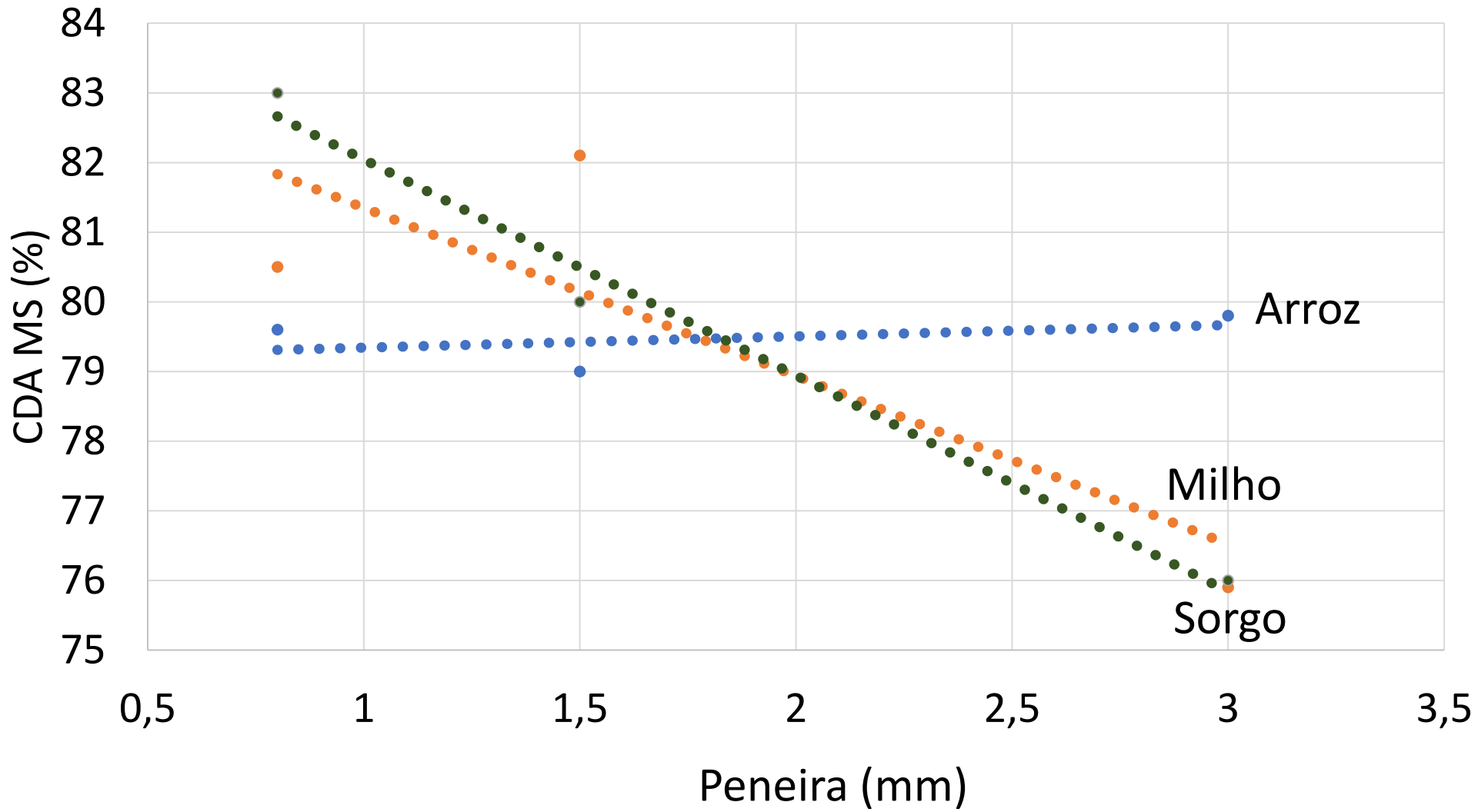

Domingues et al. (2016)

# Efeito da granulometria



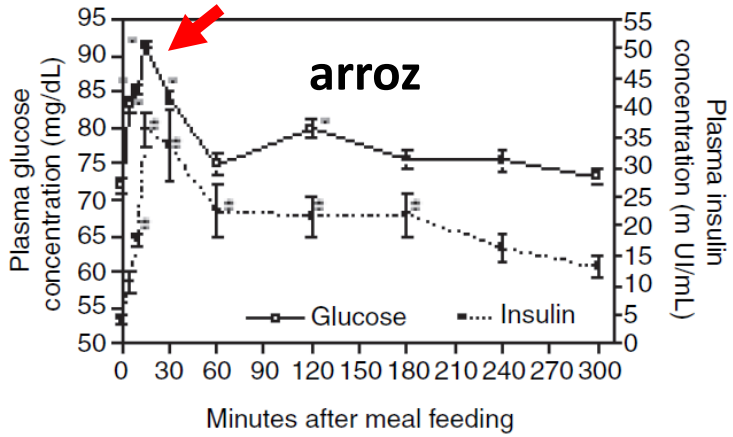

Bazoli et al. (2015)

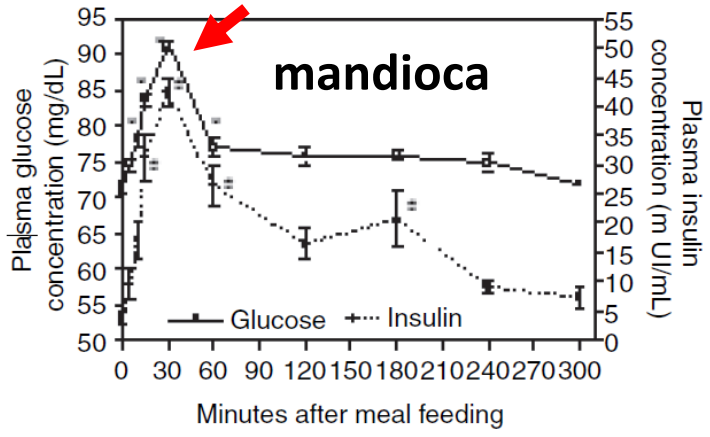
# Efeito da granulometria

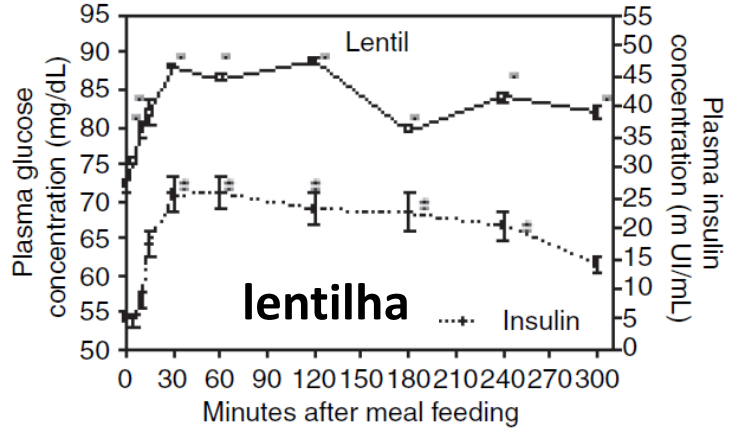


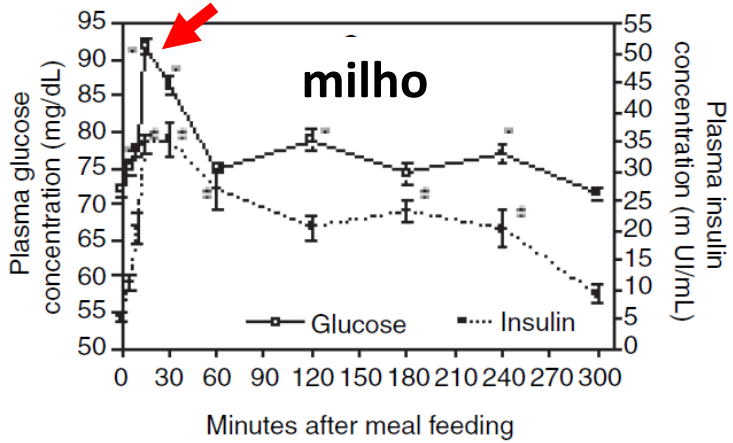

Bazoli et al. (2015)

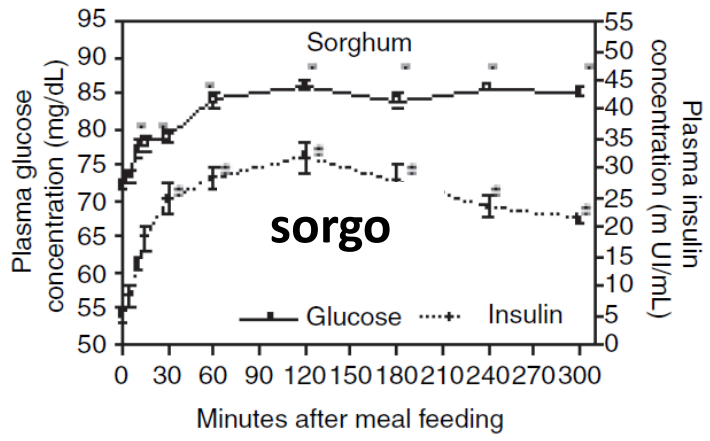
# Glicemia - cães

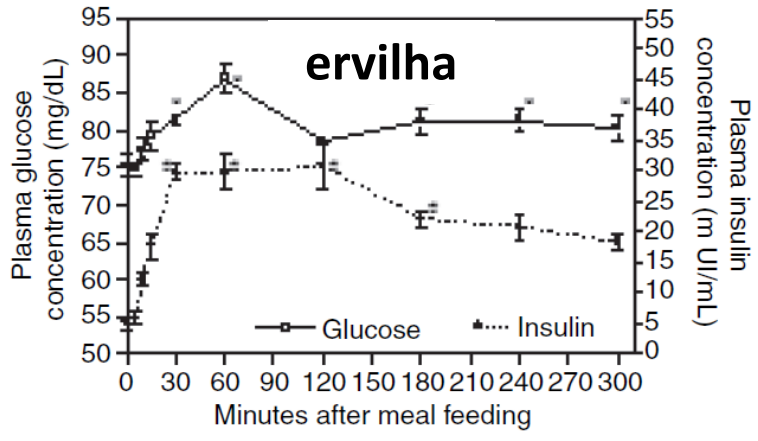


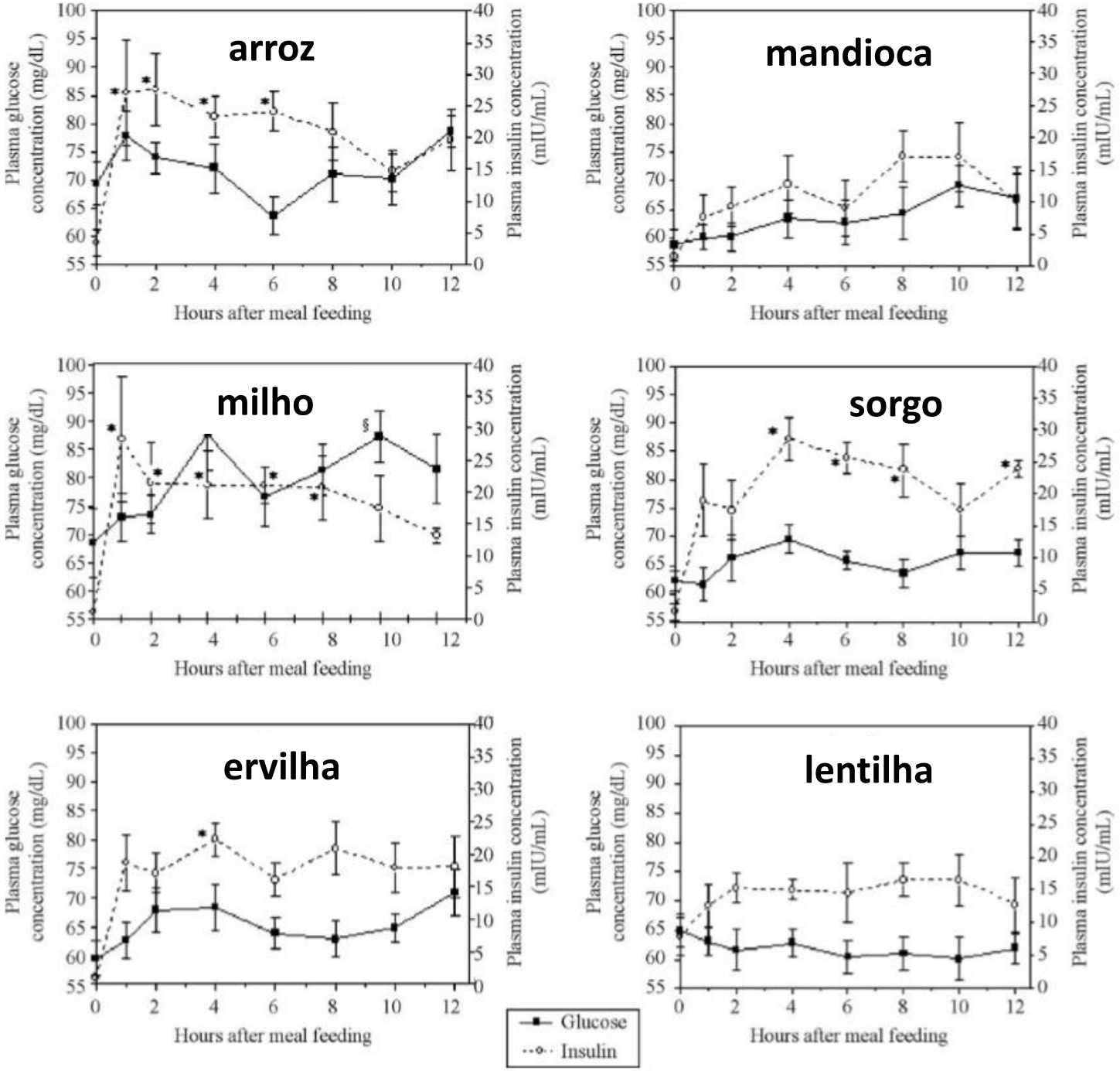




Carciofi et al. (2013)






De-Oliveira et al. (2008)

# Glicemia - cães

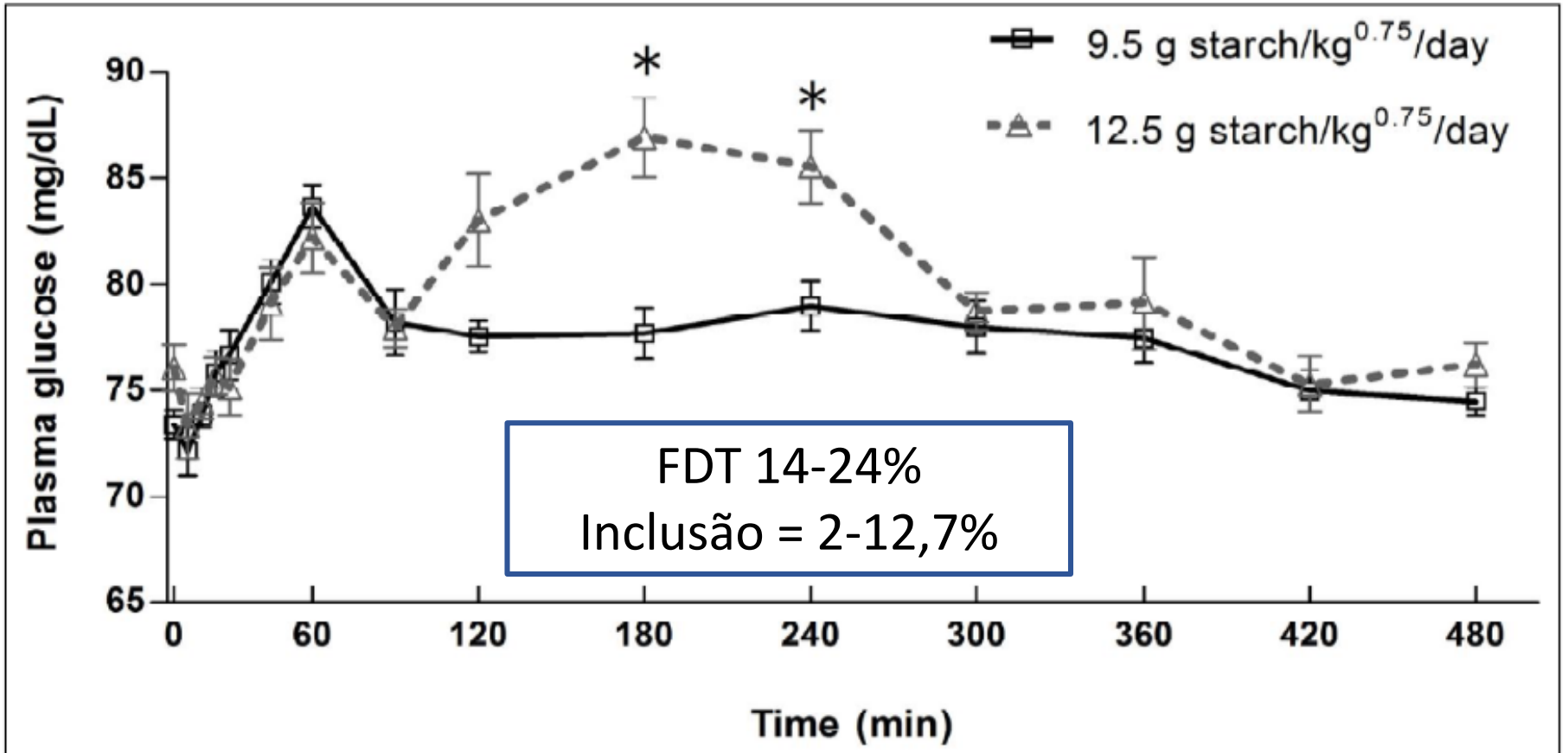
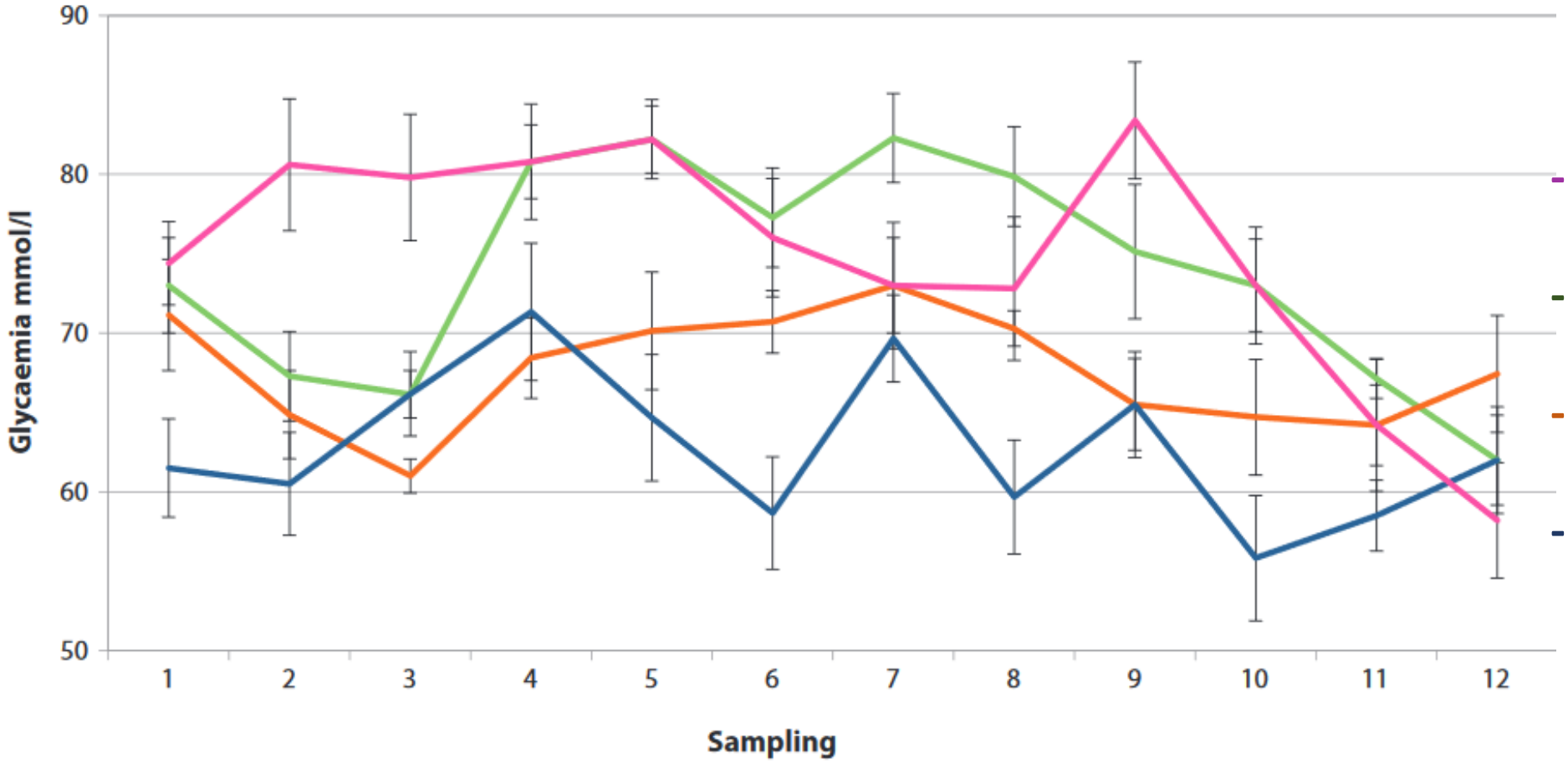



Figure 1 - Postprandial glucose response of dogs fed with experimental diets with different amounts of fibres of different solubilities, fed to achieve high (12.5g of starch (kg$^{0.75}$)$^{-1}$ day$^{-1}$) and low (9.5g of starch (kg$^{0.75}$)$^{-1}$ day$^{-1}$) starch intake (n=36 dogs per each amount of starch intake).

Monti et al. (2016)

# Glicemia - gatos




- 29% PB/35% amido

- 28% PB/34% amido

- 33% PB/26% amido

- 42% PB/17% amido

Musco et al. (2017)

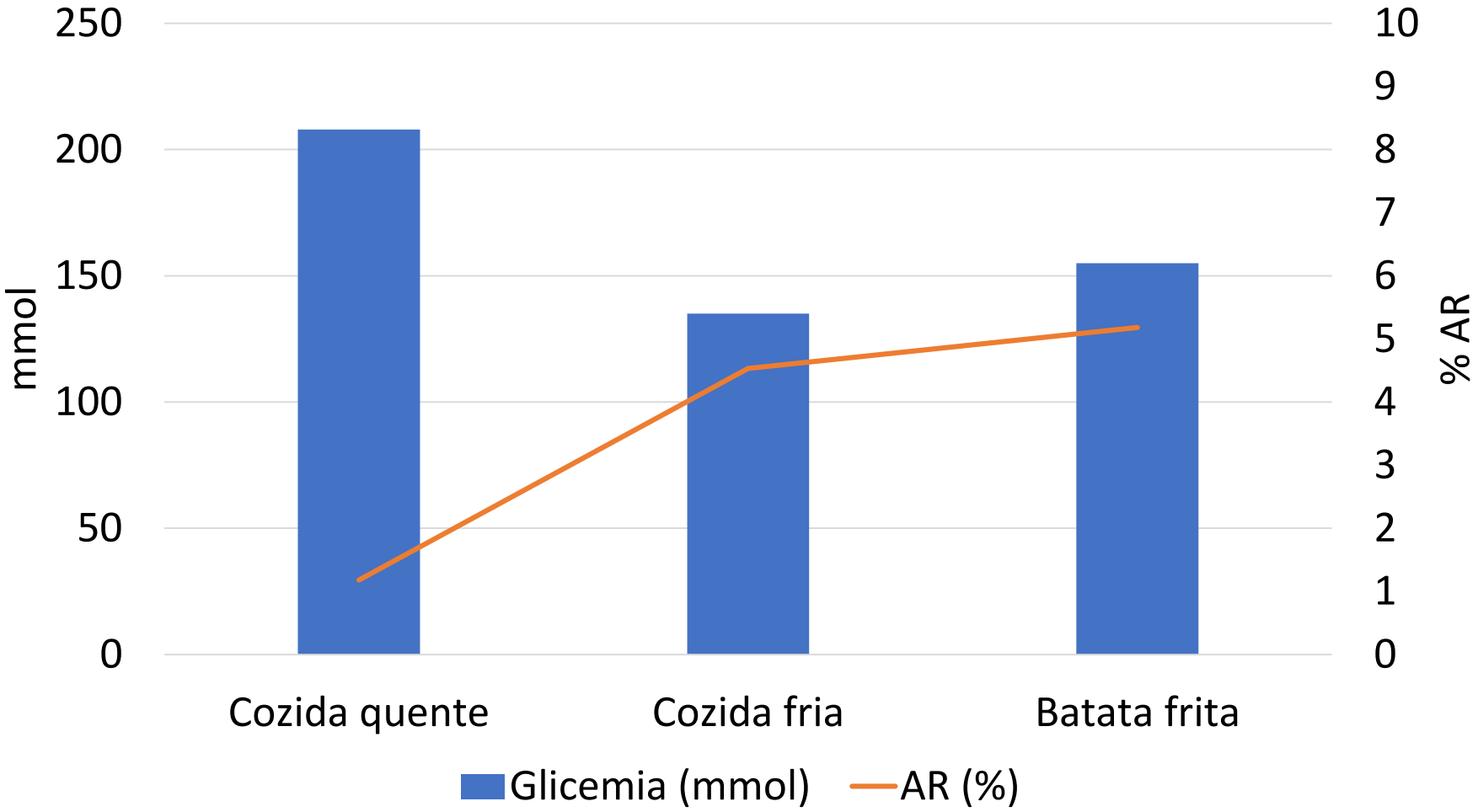








# Glicemia


250
200
150
100
50
0
mmol
10
9
8
7
6
5
4
3
2
1
0
% AR
Cozida quente
Cozida fria
Batata frita
Glicemia (mmol)
AR (%)







# Outras fontes?

- Trigo sarraceno
- Amaranto
- Grão de bico
- Batata doce
- Inhame



# Implicações

- Processo (moagem, extrusão e armazenamento) x fonte (estrutura e interação com outros componentes)
- Tubérculos mais responsivos à extrusão
- Amido não é prejudicial desde que consumido moderadamente
- Mais estudos sobre índice glicêmico em cães e gatos
- Funcionalidade x marketing x disponibilidade/custo













