Merino sheep can be bred to eat less, be more feed efficient and produce less methane quickly and cheaply

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Sheep farming difficult

Feed expensive

Produce green house gasses

More efficient/eat less = less methane?

Repeatable across ages?

Can we measure intake for less days?

Measured at 3 ages

1. Young: ~6 months, n = 1800
2. Teens: ~20 months, n = 1100
3. Adults: ~36 months, n = 450

Individual feed intake for 35 days Pellets 17% CP and 12.3 MJ

Methane & carbon dioxide portable respiration chambers for 40 minutes

Genetic analysis

trait ~ μ + fixed effects + random effects

group

birth type/rear type

sex

pen

age

run

box

additive genetic

maternal genetic

maternal environment

Intake most heritable
Carbon dioxide more heritable than methane

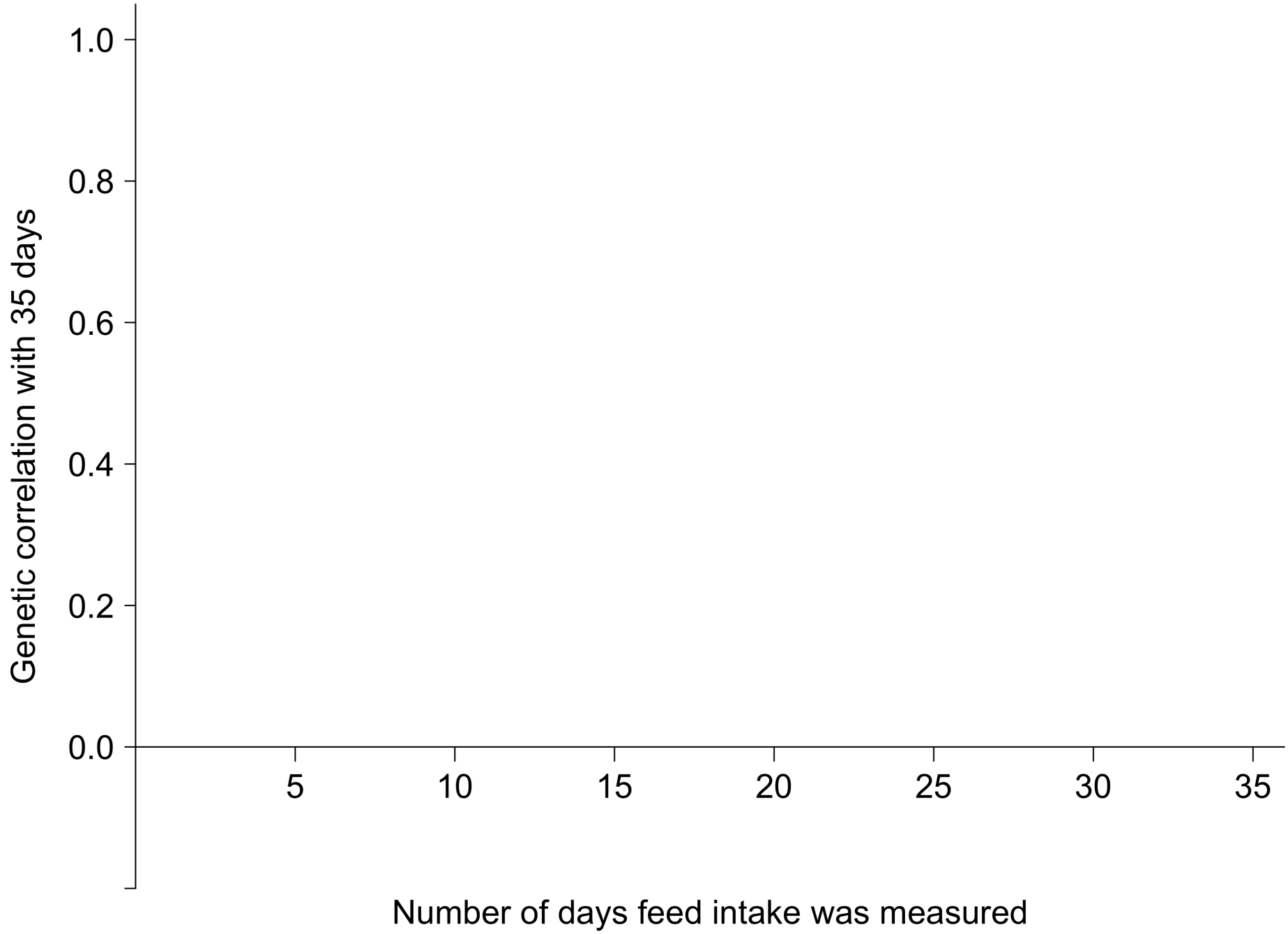
Trait	**Heritability range**
Feed Intake	0.31 to 0.49
Residual feed intake	0.17 to 0.29
Methane	0.10 to 0.14
Carbon dioxide	0.08 to 0.28

More feed efficient teens that eat less also produce less methane (r_g= 0.76)

Carbon dioxide can be used to select for feed intake (r_g = 0.86 to 0.96) and feed efficiency (r_g = 0.65 to 0.68)

Can select all traits in young or teens decrease generation interval

Trait	Young/teen	Teen/adult	Young/adult
Intake	**0.74 (0.09)**	**0.78 (0.12)**	**0.64 (0.17)**
Residual feed intake	0.36 (0.22)	**0.75 (0.74)**	0.00 (0.53)
Methane	**0.81 (0.14)**	0.62 (0.26)	**0.86 (0.15)**
Carbon dioxide	**0.76 (0.16)**	**0.90 (0.22)**	0.03 (0.56)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Genetic correlation with 35 days
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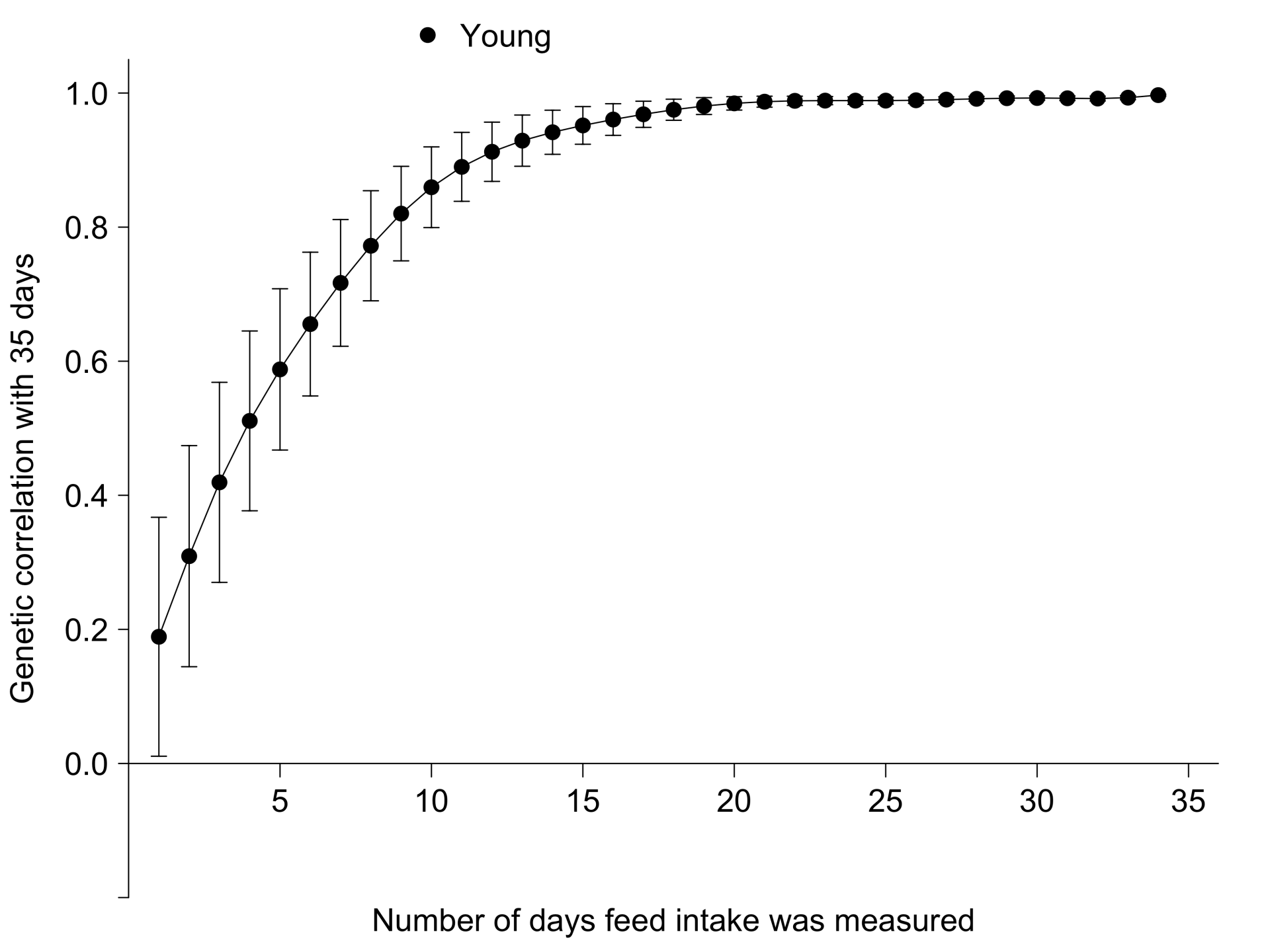
Number of days feed intake was measured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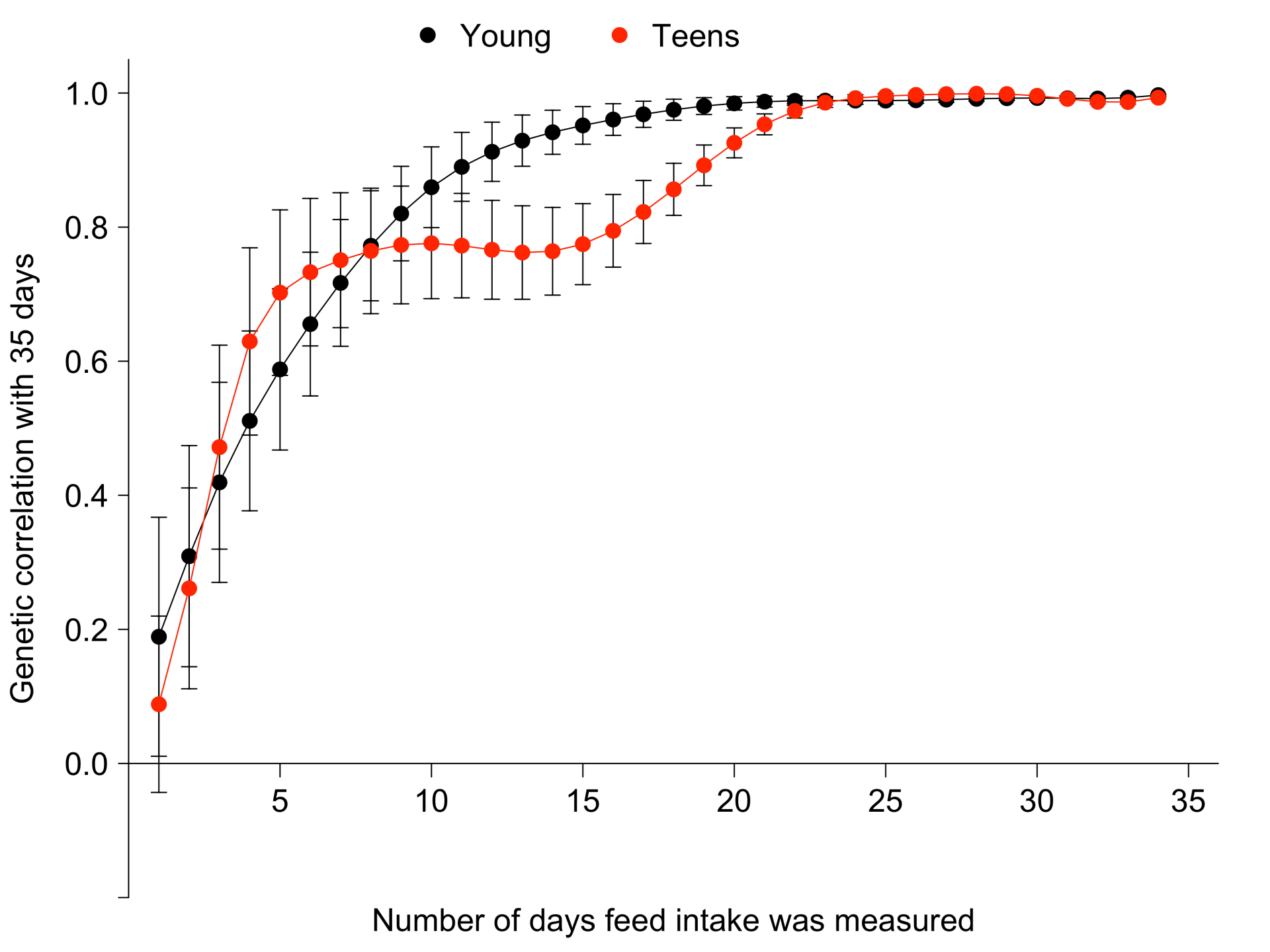
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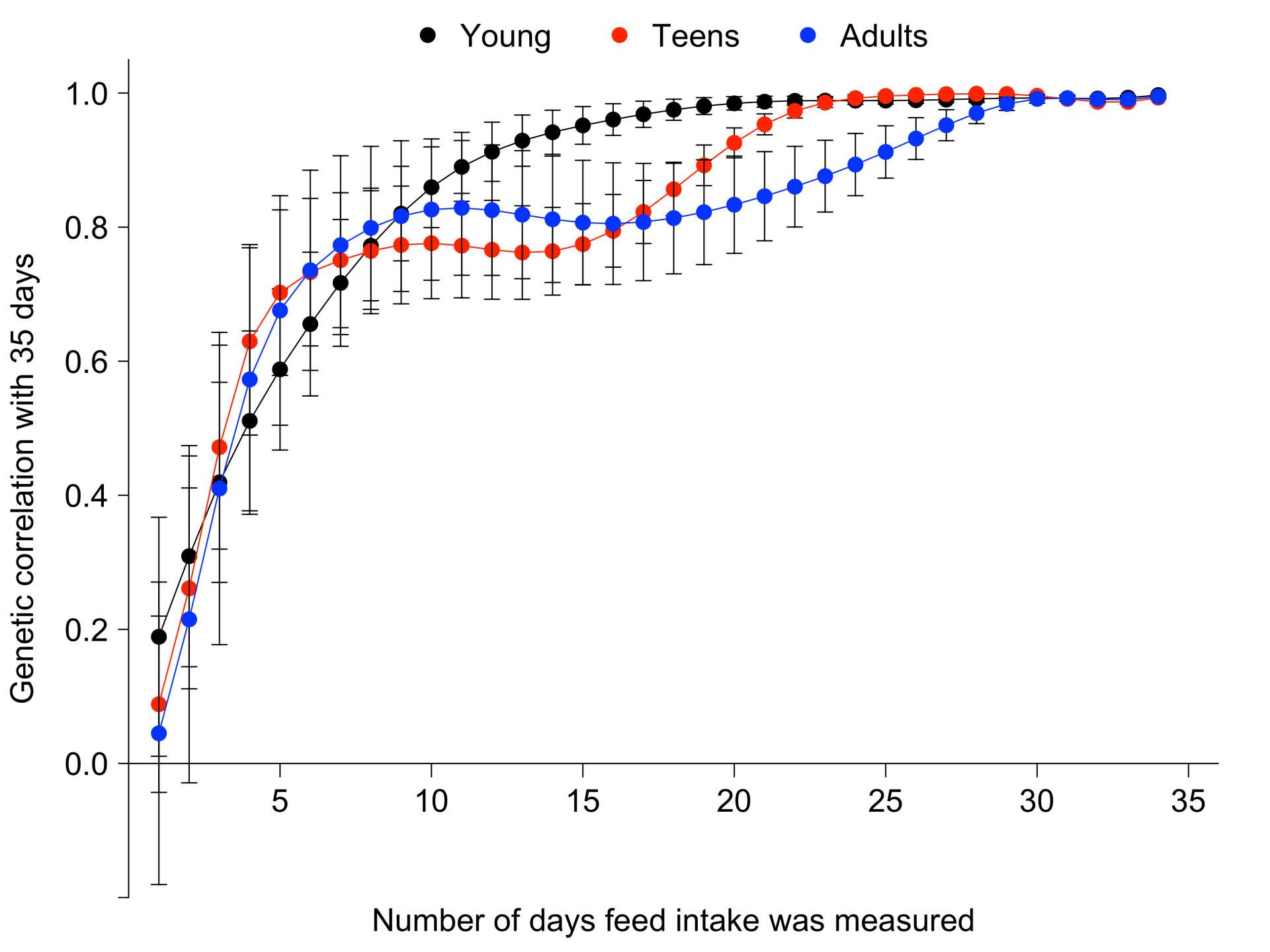
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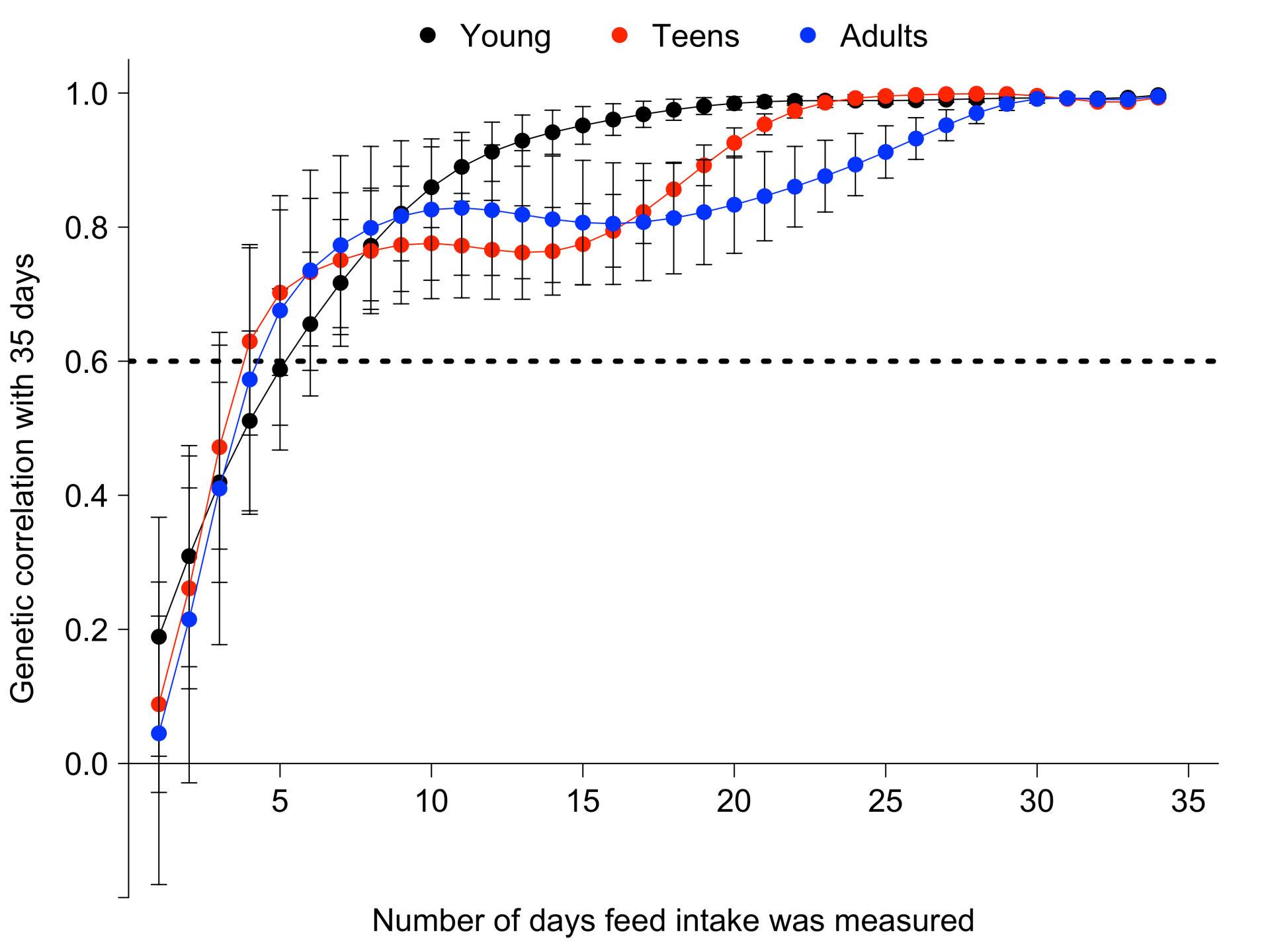
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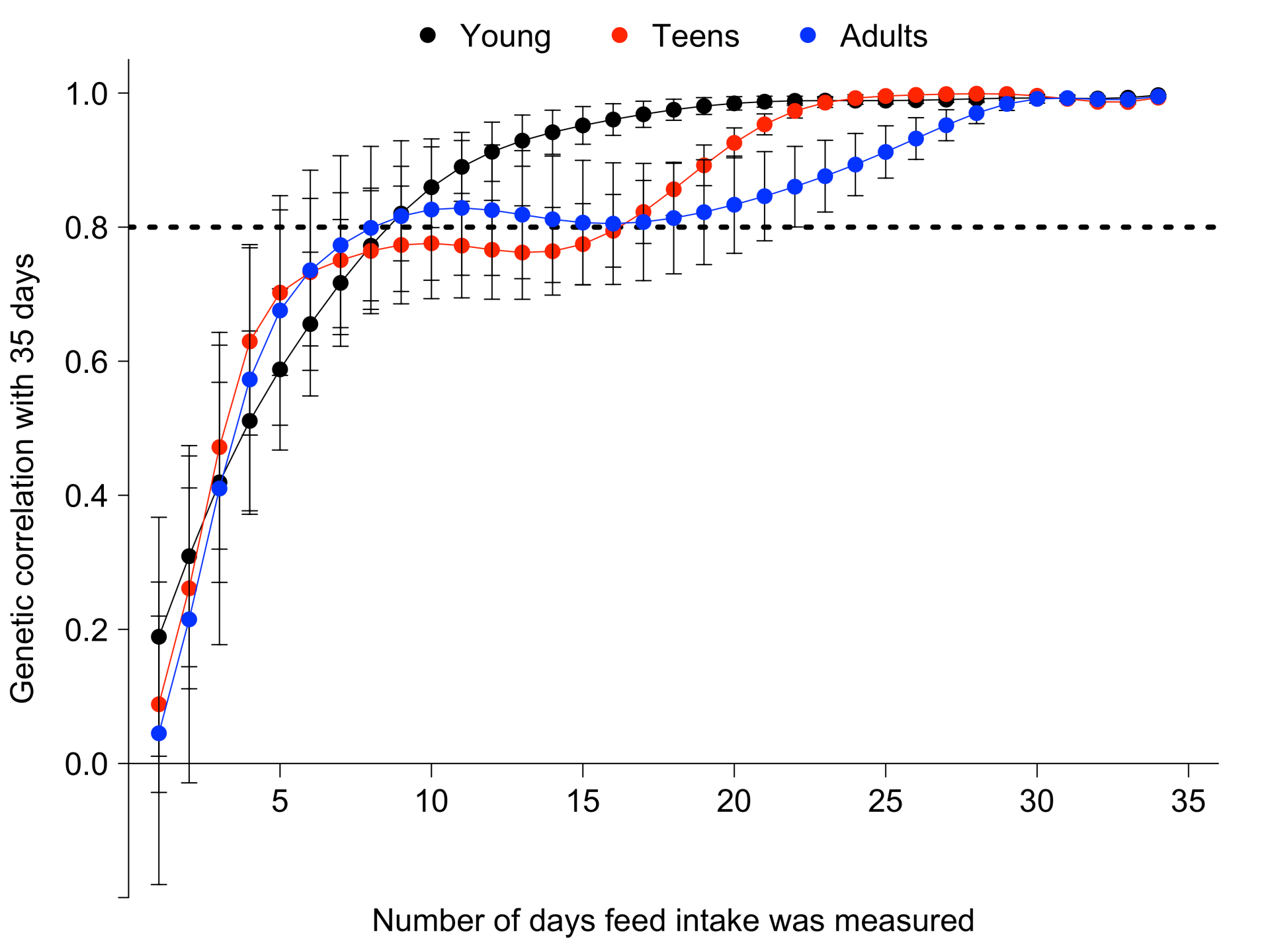
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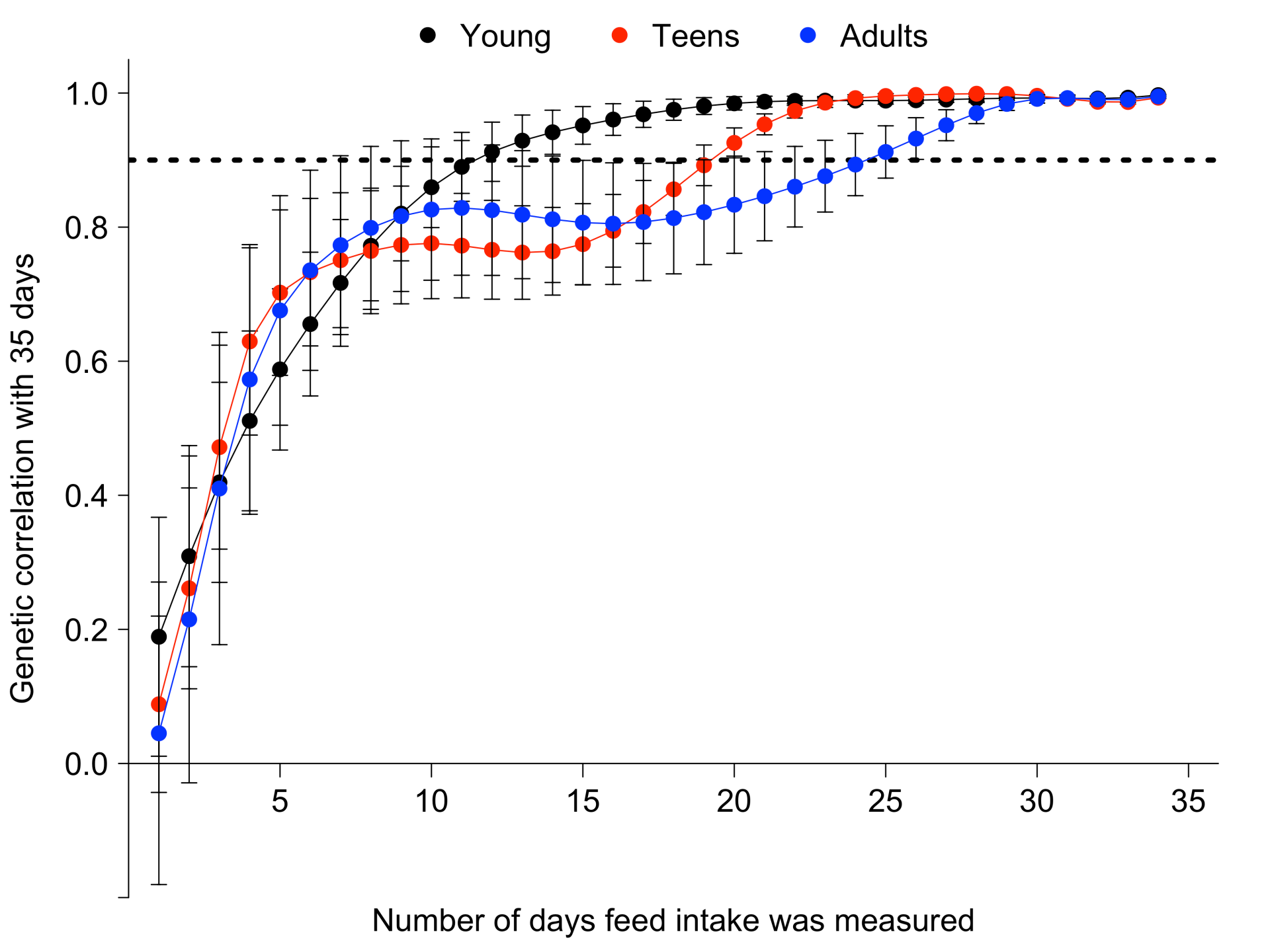
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Repeatable across ages ☑

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Sheep mostly graze outside

Different feed types?