Amino acid requirements of black soldier fly larvae

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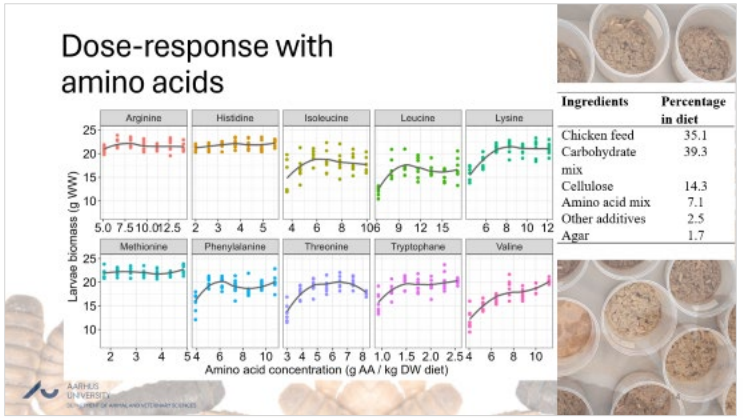
Overview

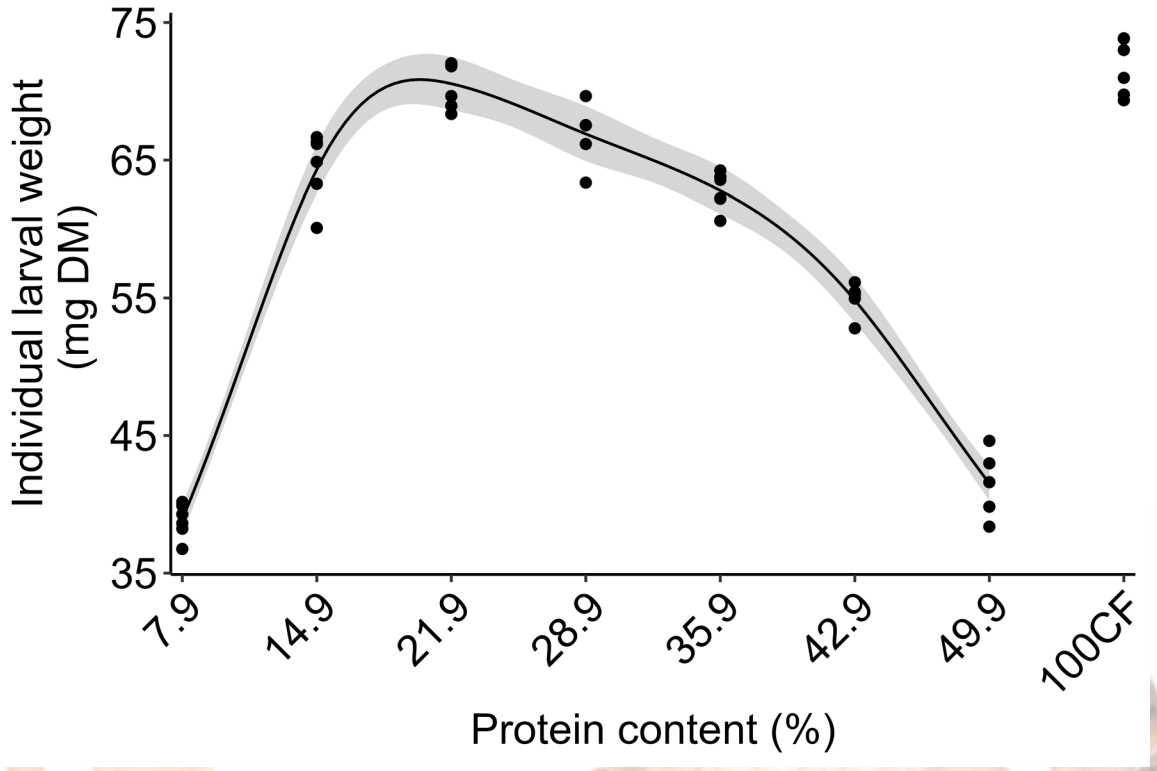
Experiment 1

Experiment 2

Experiment 3



Designing the experimental diet



Designing the feed

Requirements

- Fulfill larval nutritional requirements
  - Deficiencies in other nutrients will affect the results
- Possible to remove the amino acid that is examined

Challenges

- Not enough knowledge about nutritional requirements (micronutrients)

Choosing ingredients

How much protein is required?

Chicken feed

Cellulose

Rapeseed oil, sunflower oil, lard 1:1:1

Lipid mix

Sucrose and dextrin 1:1

Carbohydrate mix

Vitamins, minerals, nipagin and more

Other additives

Casein and peptone 1:1

Protein mix

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Experimental diets

		Experimental Diets						
Ingredients, %		**7.9**	**14.9**	**21.9**	**28.9**	**35.9**	**42.9**	**49.9**
Chicken feed	34.5							
Carbohydrate mix		45.6	38.6	31.4	24.3	17.2	10.1	3.0
Protein mix		0	7.0	14.0	21.0	28.0	35.0	42.0
Cellulose								
Lipid mix								
Other additives								
Nutrient, %	**CF**							
Carbohydrate								
Digestible carbohydrates								
Protein	7.9							
Lipid								
Vitamins and minerals								

Experimental diets

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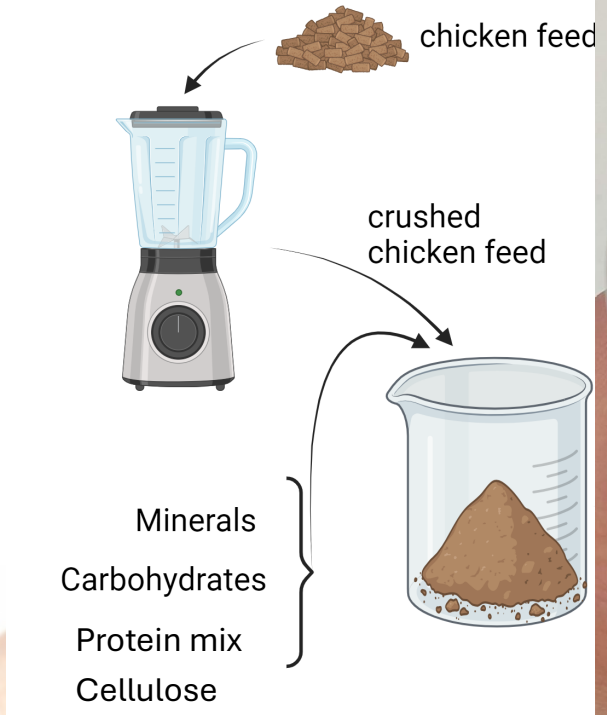
Protein mix		0	7.0	14.0	21.0	28.0	35.0	42.0
Cellulose	14.0							
Lipid mix	3.4							
Other additives	2.5							
Nutrient, %								
Carbohydrate		83.0	76.2	69.0	61.9	54.8	47.7	40.6
Protein		7.9	14.9	21.9	28.9	35.9	42.9	49.9
Lipid	5.2							
Vitamins and minerals	3.6							

Energy	
Protein	17 kJ/g
Carbohydrates	17 kJ/g
Fat	37 kJ/g

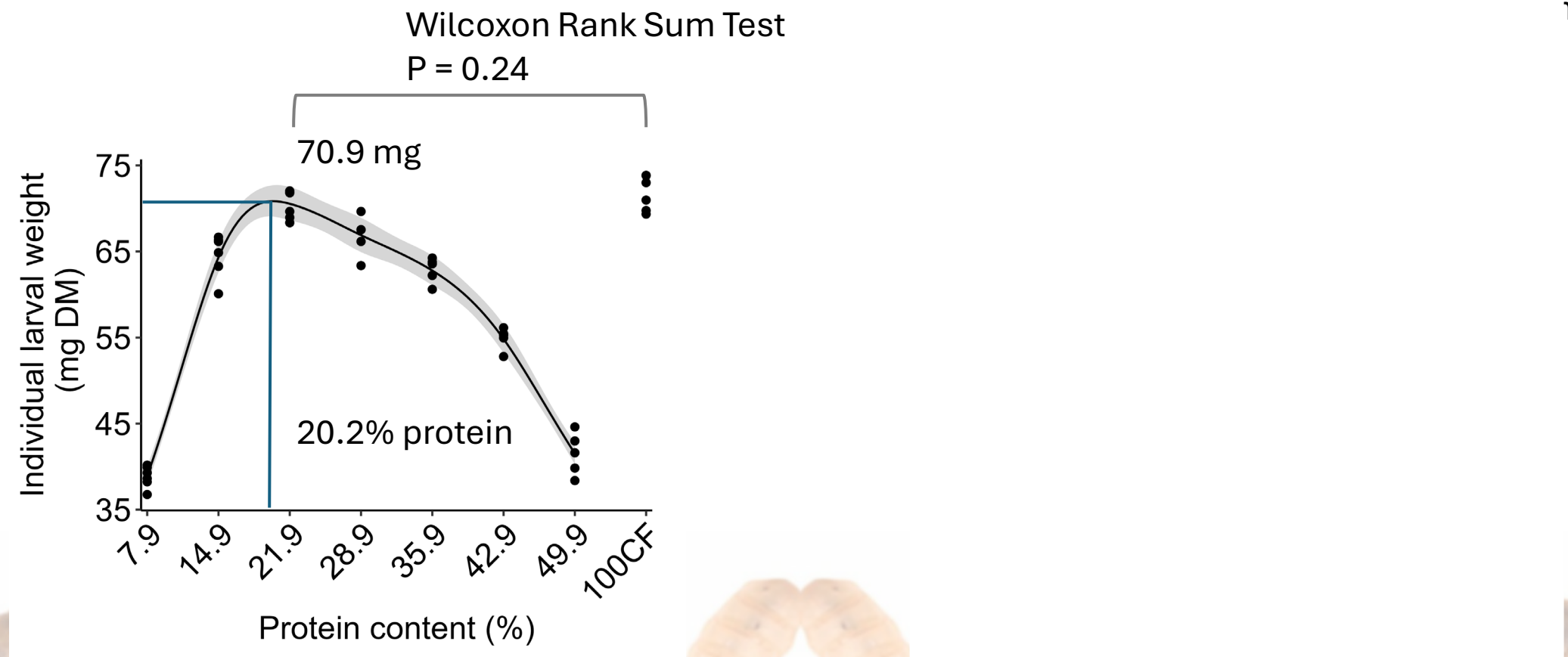
Method

- Seven replicates per treatment
- Larvae start 4-5 days old
- Experiment lasted for eight days
- Room temperature and humidity:

  29.5 ± 1.2 °C and 64.9 ± 4.6 % RH



Results



Generalized Additive Model
5.8 degrees of freedom

Reducing single amino acid

Screening experiment

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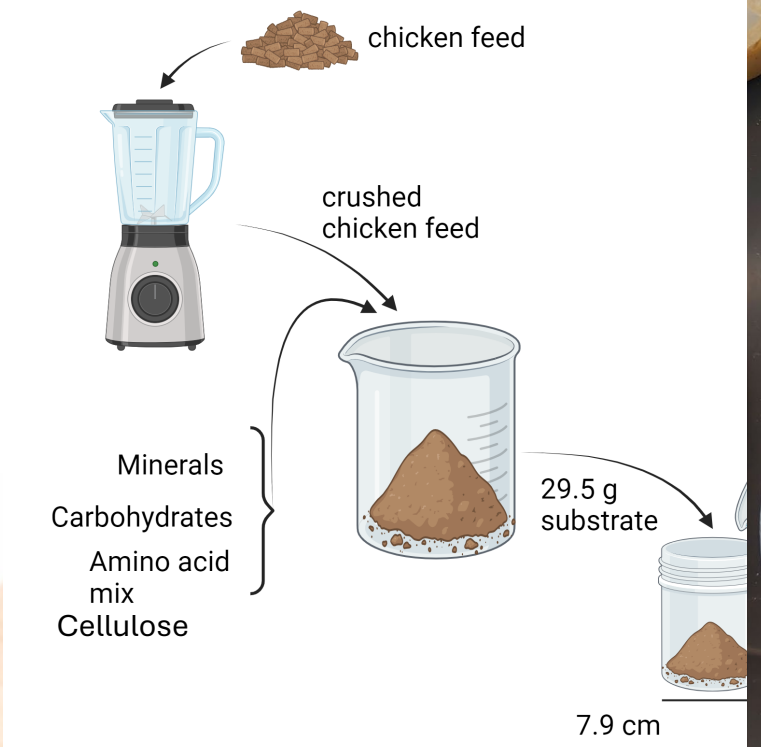
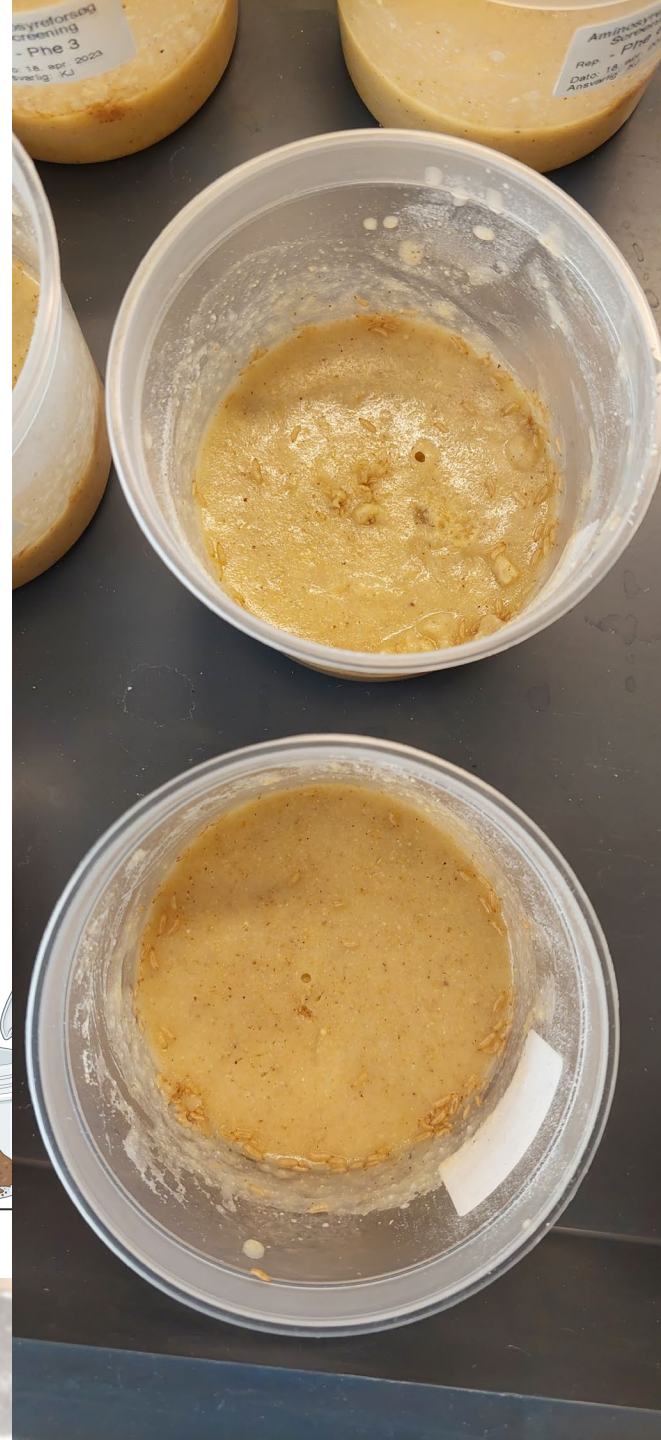
Method

Ingredients	Percentage in diet
Chicken feed	35.1
Carbohydrate mix	39.3
Cellulose	14.3
Amino acid mix	**7.1**
Other additives	2.5
Agar	1.7

Nutrition	
Carbohydrate	76.6
Digestible carbohydrates	61.1
Protein	**15.2**
Vitamins and minerals	3.6
Fat	1.8



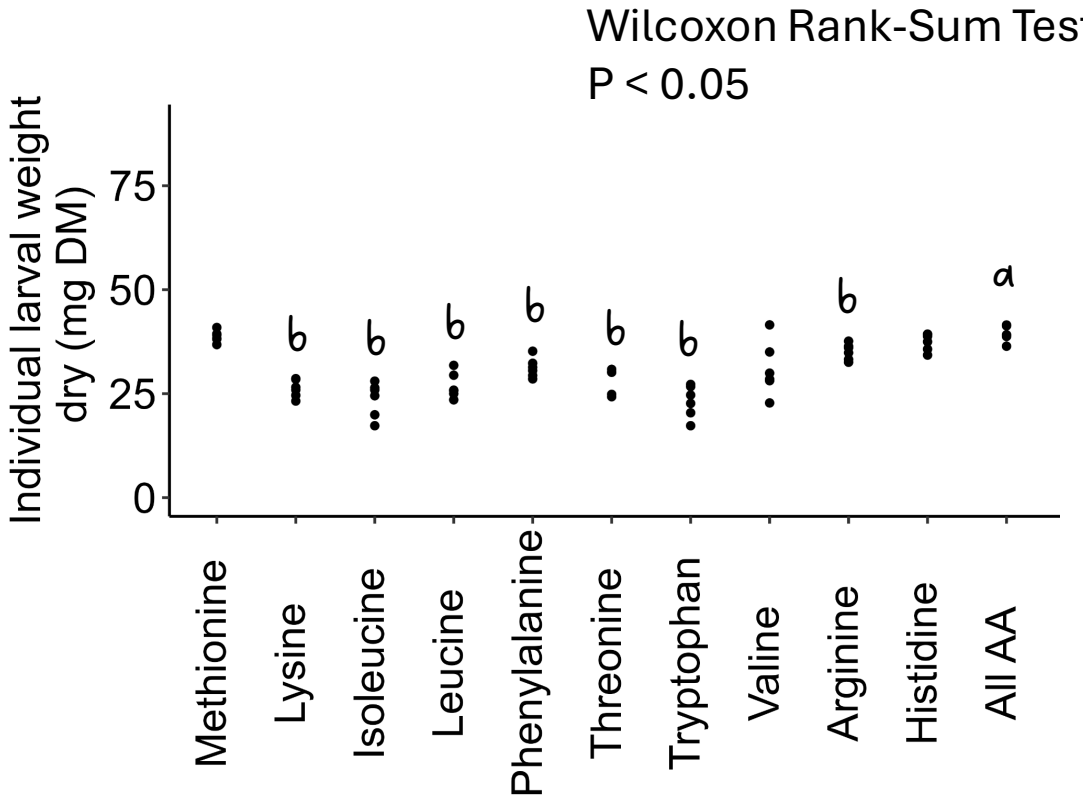


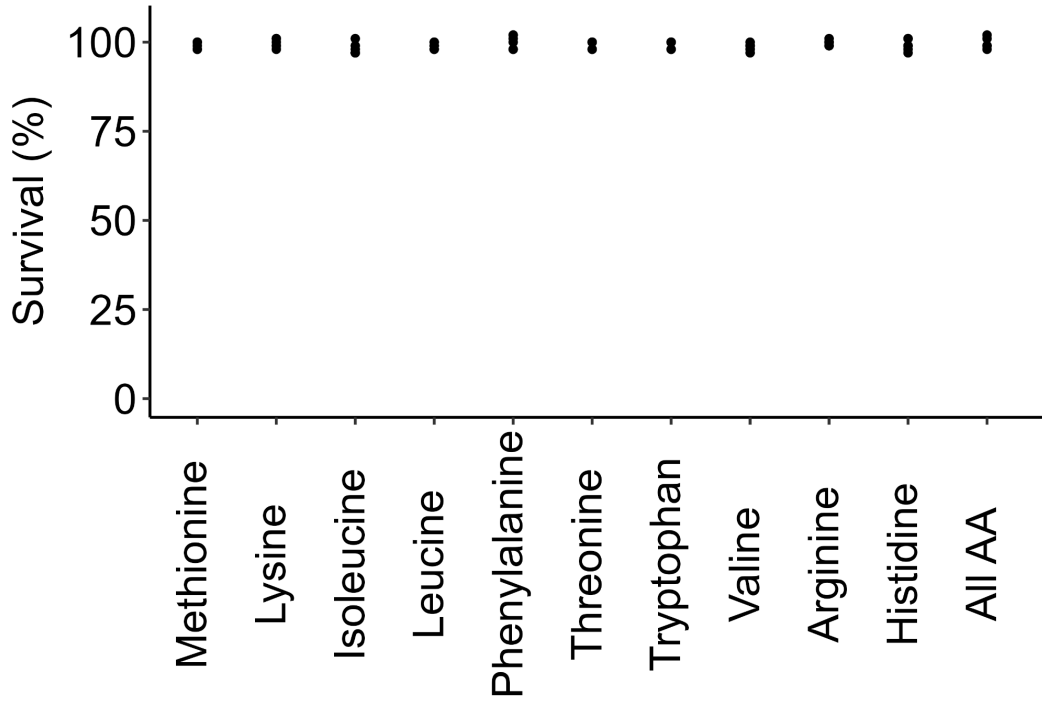
The amino acids

Amino acids	**Diet**										
	All AA	Met	Lys	Ile	Leu	Phe	Thr	Trp	Val	Arg	His
Methionine (Met)	2.2	1.16	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Lysine (Lys)	5.5	5.5	2.90	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Isoleucine (Ile)	4.5	4.5	4.5	2.38	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Leucine (Leu)	7.7	7.7	7.7	7.7	4.08	7.7	7.7	7.7	7.7	7.7	7.7
Phenylalanine (Phe)	4.8	4.8	4.8	4.8	4.8	2.57	4.8	4.8	4.8	4.8	4.8
Threonine (Thr)	3.7	3.7	3.7	3.7	3.7	3.7	1.97	3.7	3.7	3.7	3.7
Tryptophan (Trp)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.61	1.1	1.1	1.1
Valine (Val)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.67	5.0	5.0
Arginine (Arg)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	3.38	6.3
Histidine (His)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.32
non-essential AA mix	**56.8**	**57.8**	**59.3**	**58.9**	**60.4**	**59.0**	**58.5**	**57.3**	**59.1**	**59.8**	**57.9**

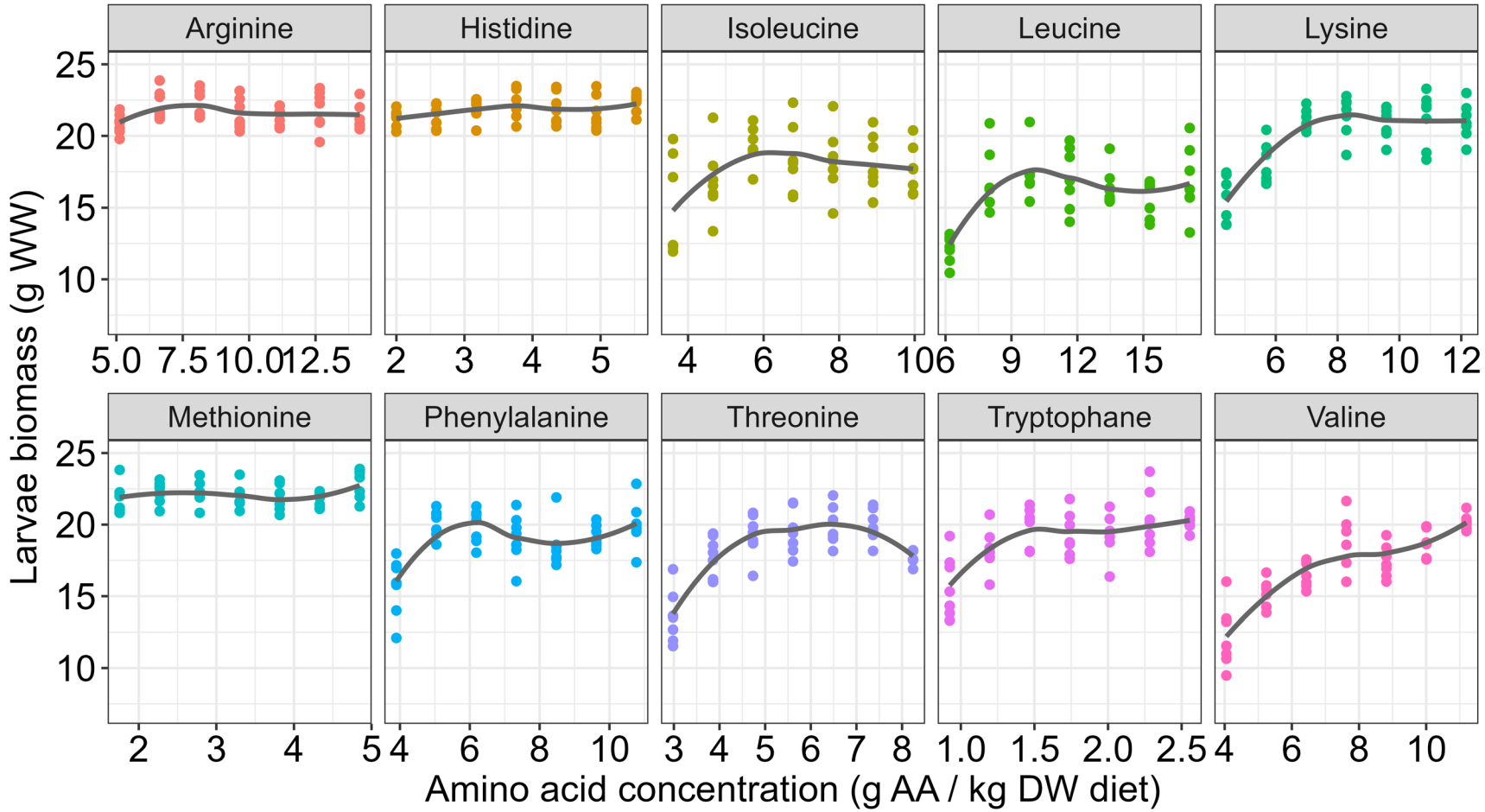
Values are percentage AA of total protein

Results – removing 7 of 10 AA affects growth





Dose-response with amino acids



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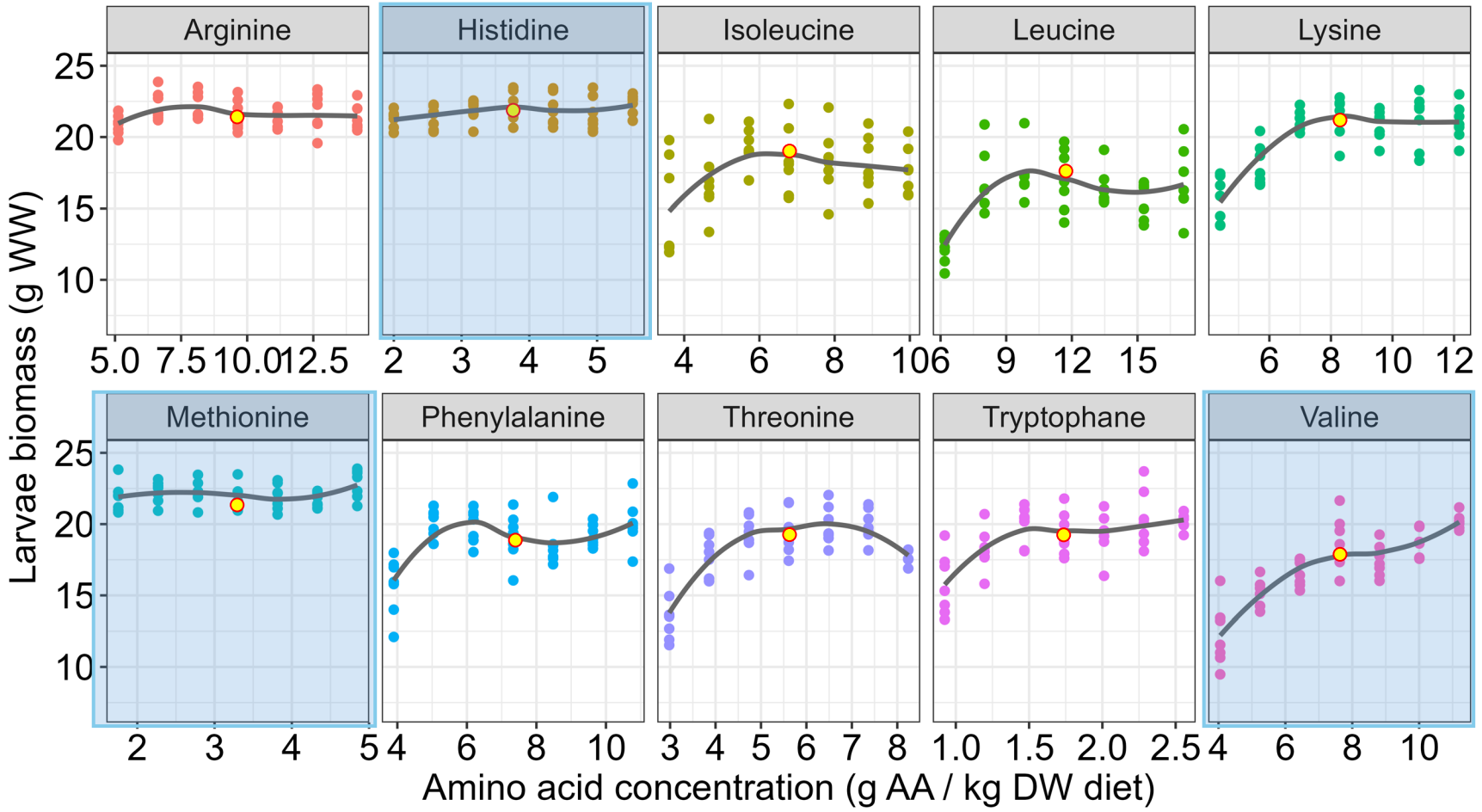
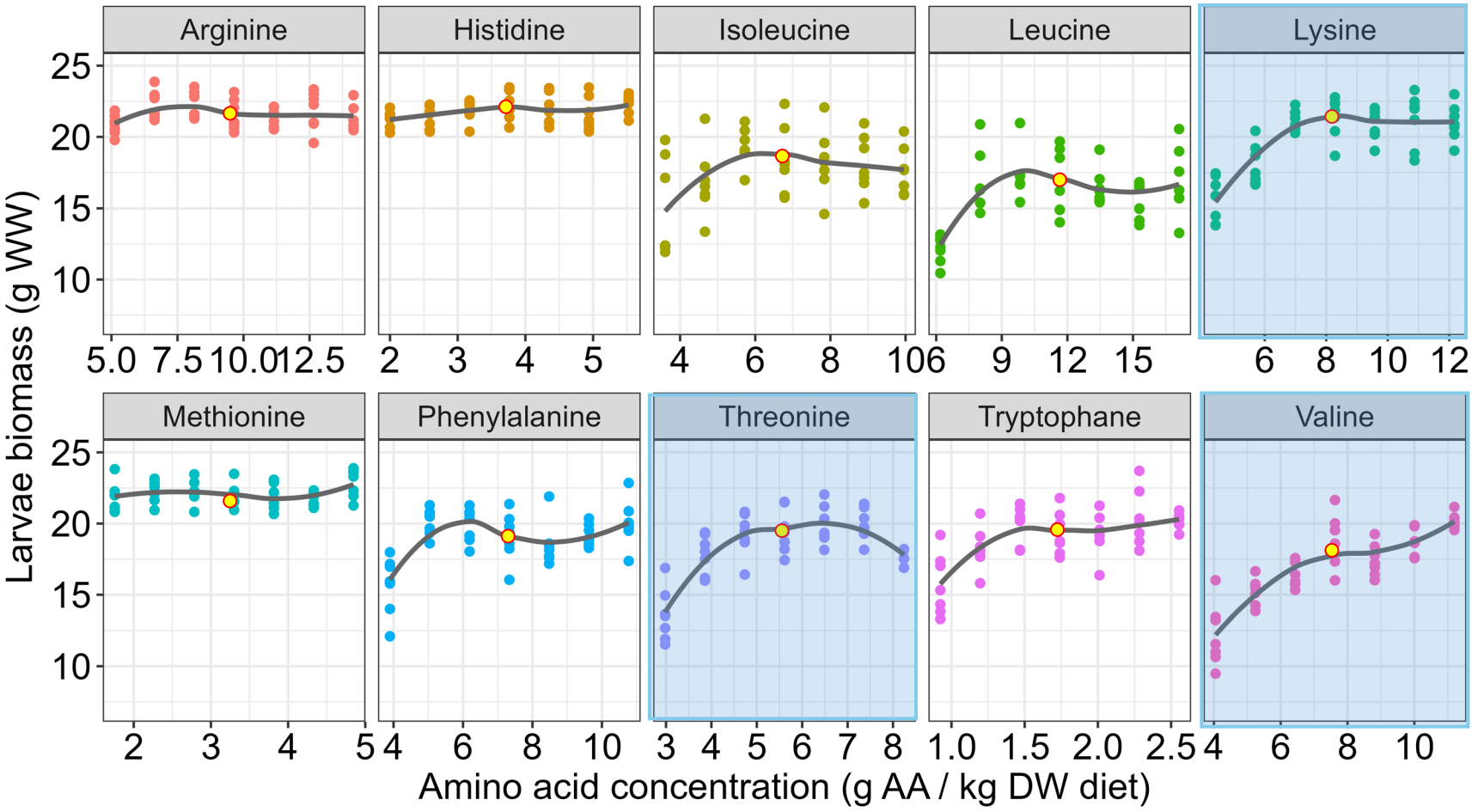
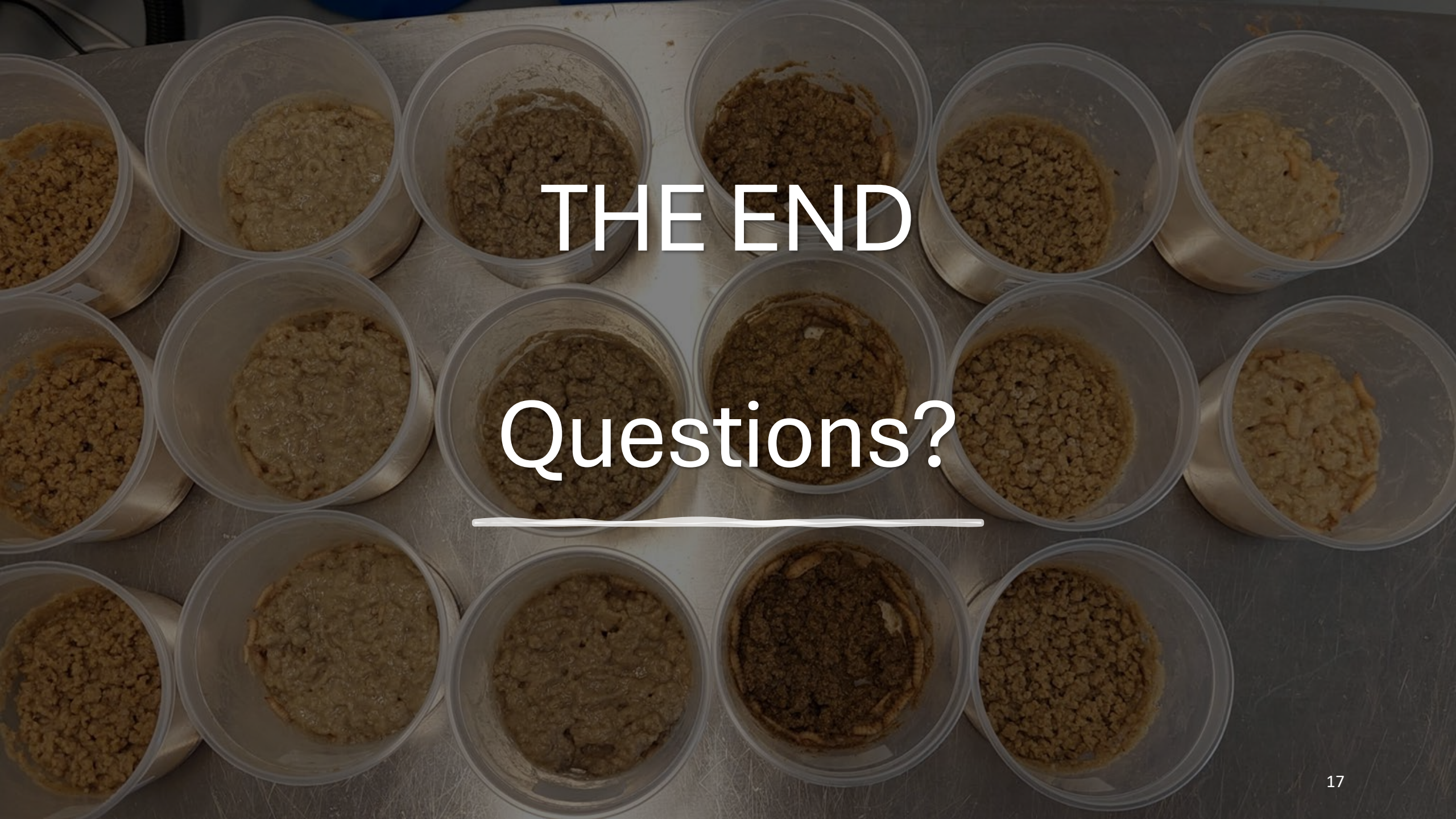


No effect of reducing in previously experiment

The AA composition in CF is not optimal



Required in levels equal to chicken feed or higher


THE END
Questions?

Overview

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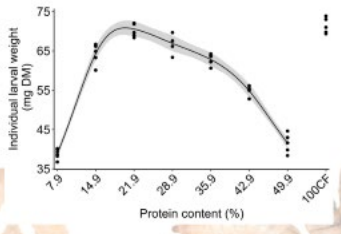
Designing the experimental diet



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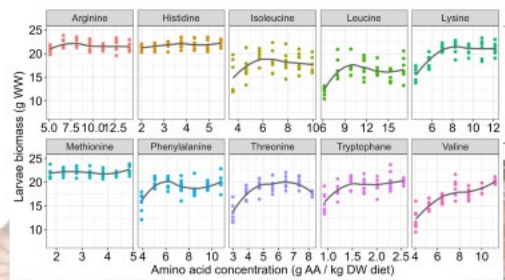
Reducing single amino acid

Screening experiment

Experiment 3

Dose-response with amino acids



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