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WEBINAR SERIES

Rebuilding Cow Condition

Presented by SHAUN BALEMI

QUESTION 1

Why bother with condition measurement & gain in late lactation? Why not just leave it to the dry period?

- What is cow condition doing through the season?
- Is a change of condition a change in fat or protein?
- Why is it best to start condition rebuilding early?

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QUESTION 2

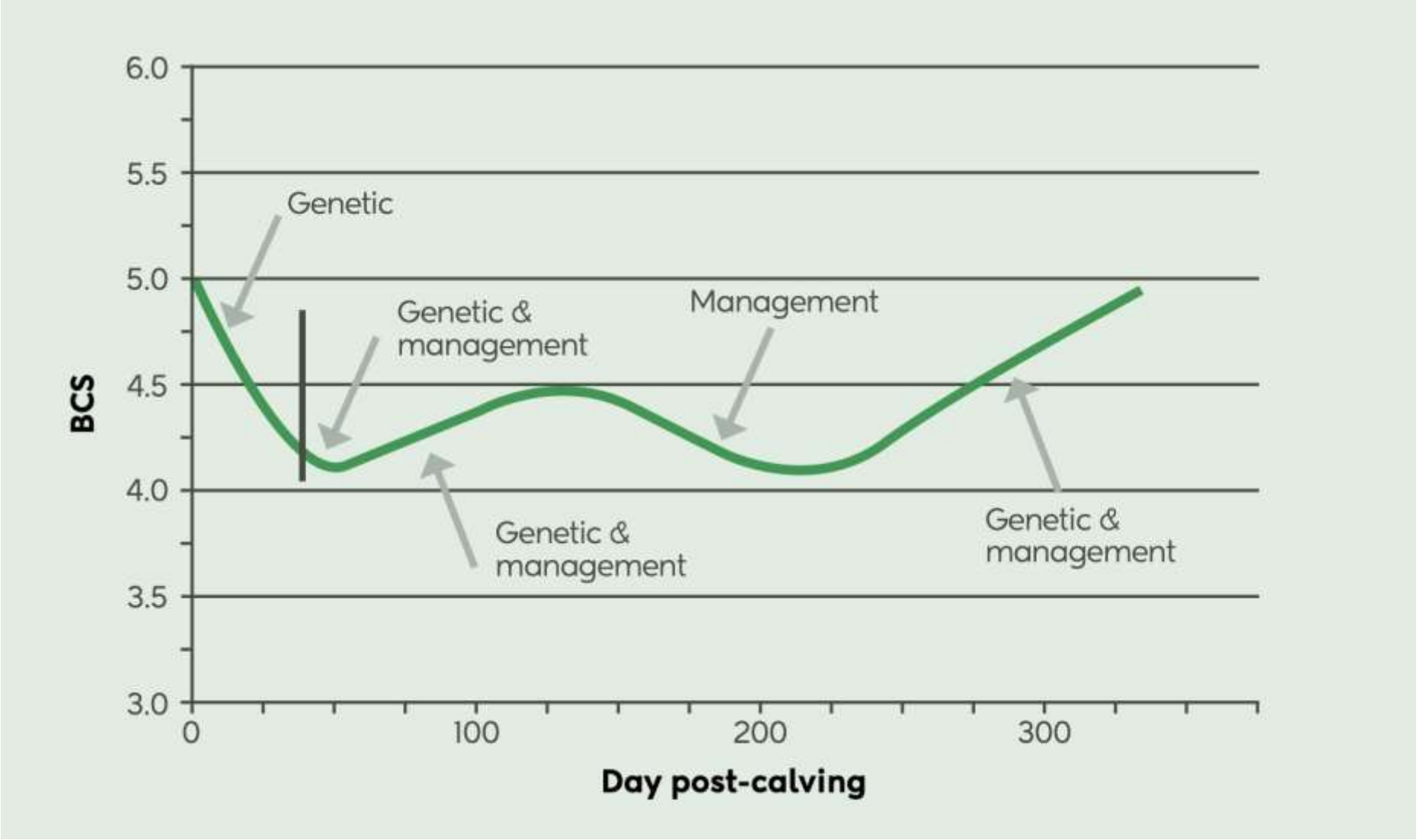
How do we manage our cows & their diet to maximise condition gain efficiency?

- What are the key metabolic drivers for condition gain?
- Best feeding strategies for condition gain while maintaining production?
- Best energy sources for condition gain
- Ensure protein levels are sufficient
- Key mineral gaps to ensure are not limiting condition growth

QUESTION 3

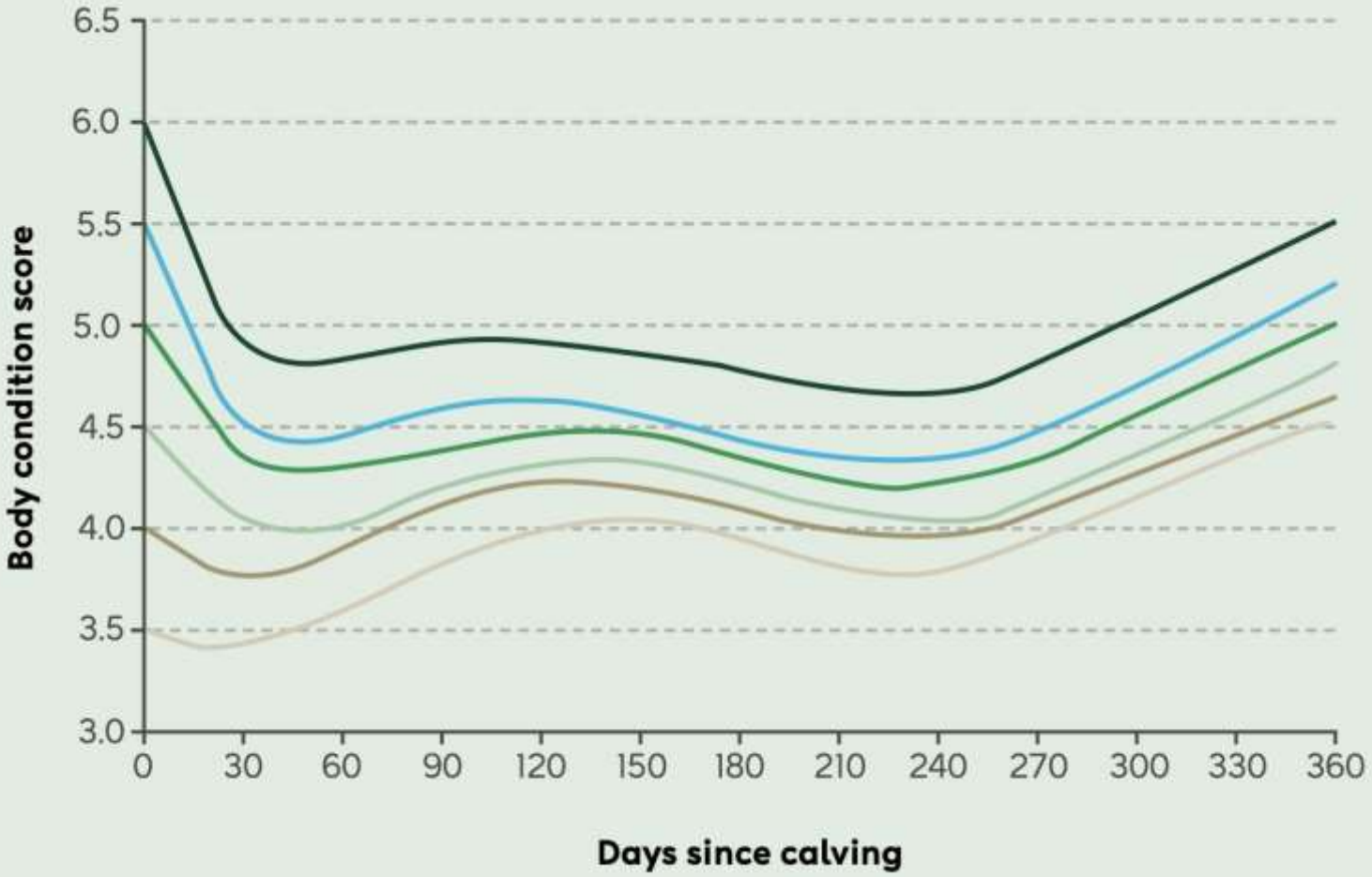
How do the different fat storage dynamics affect how we manage cow condition? And how do these fat stores affect the cow?

WHAT IS COW CONDITION DOING THROUGH THE SEASON?



DairyNZ BCS Guide 2024

DOES BCS STARTING POINT MAKE A DIFFERENCE?



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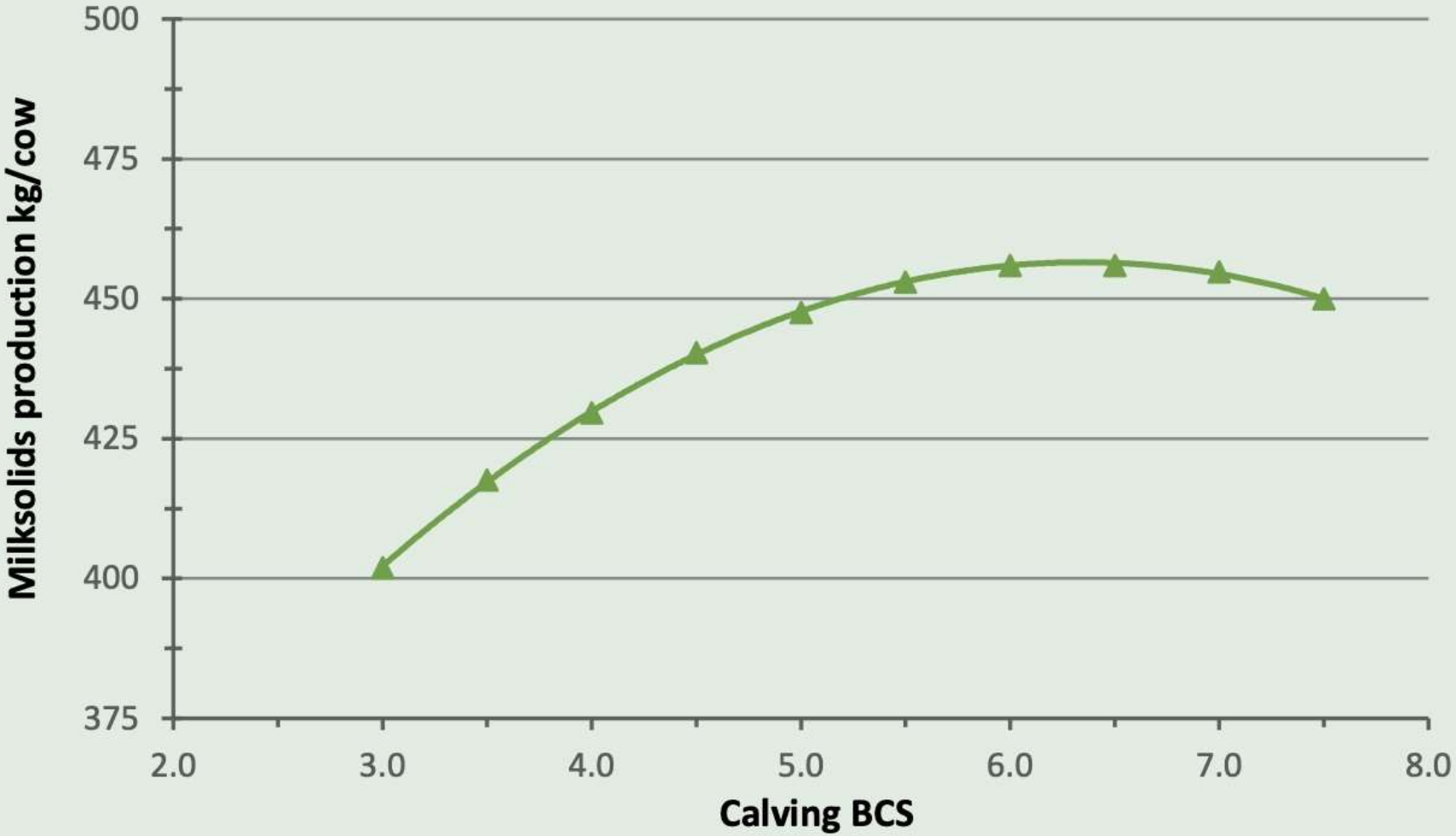
BCS & MILK PRODUCTION?



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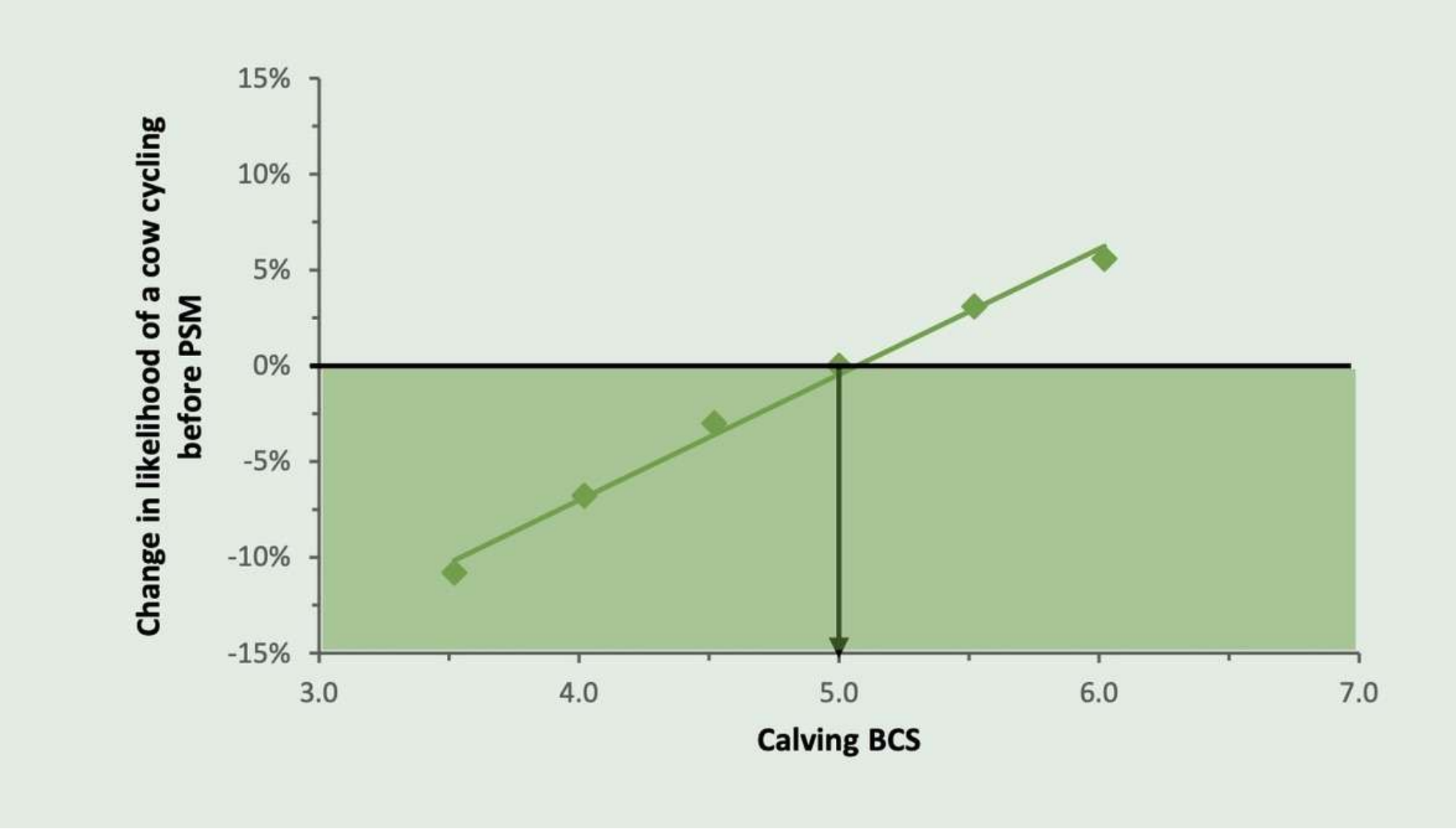
BCS & LIKELIHOOD OF A COW CYCLING BEFORE PSM



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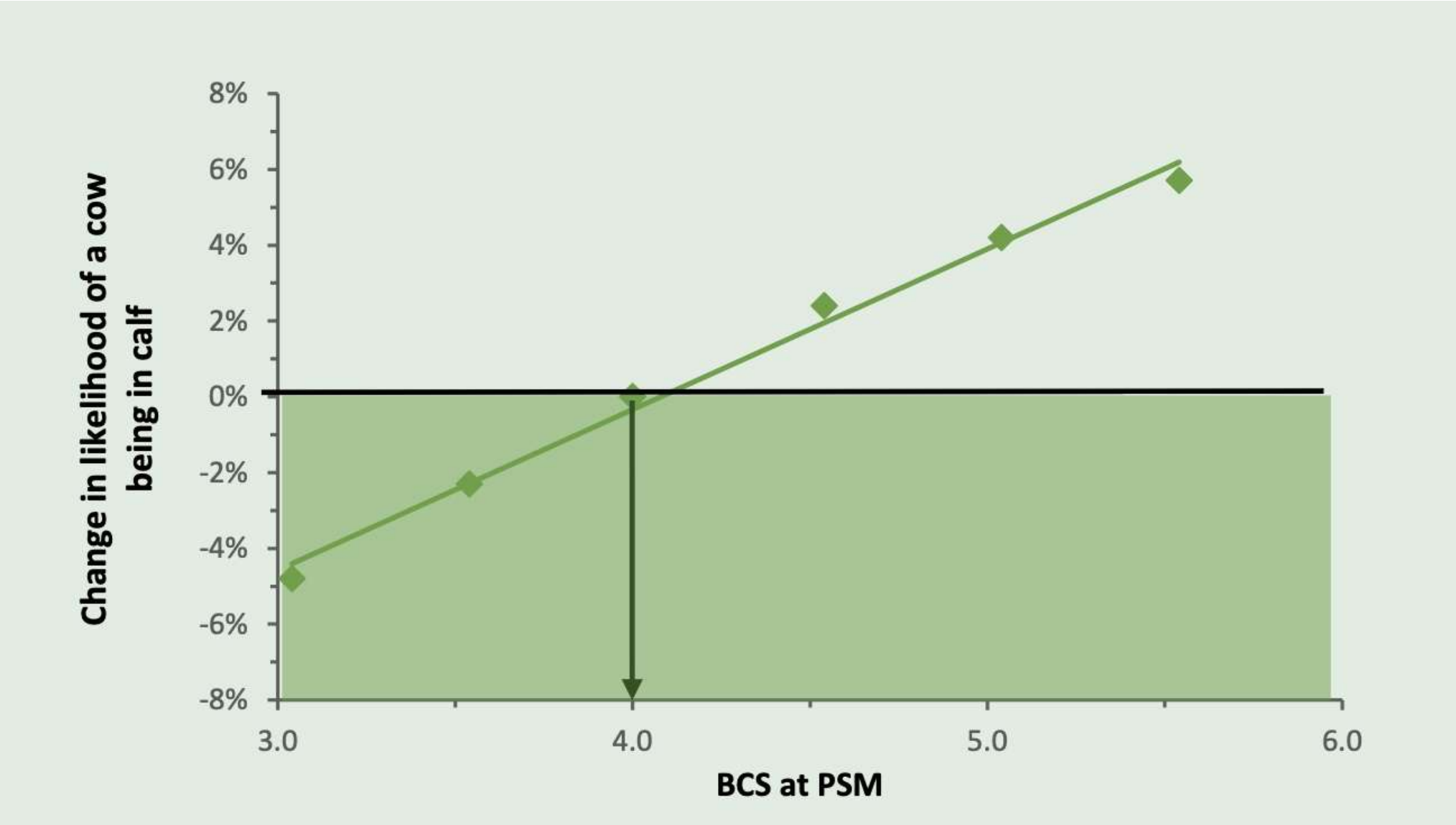
BCS @ PSM AND LIKELIHOOD OF MATING SUCCESS



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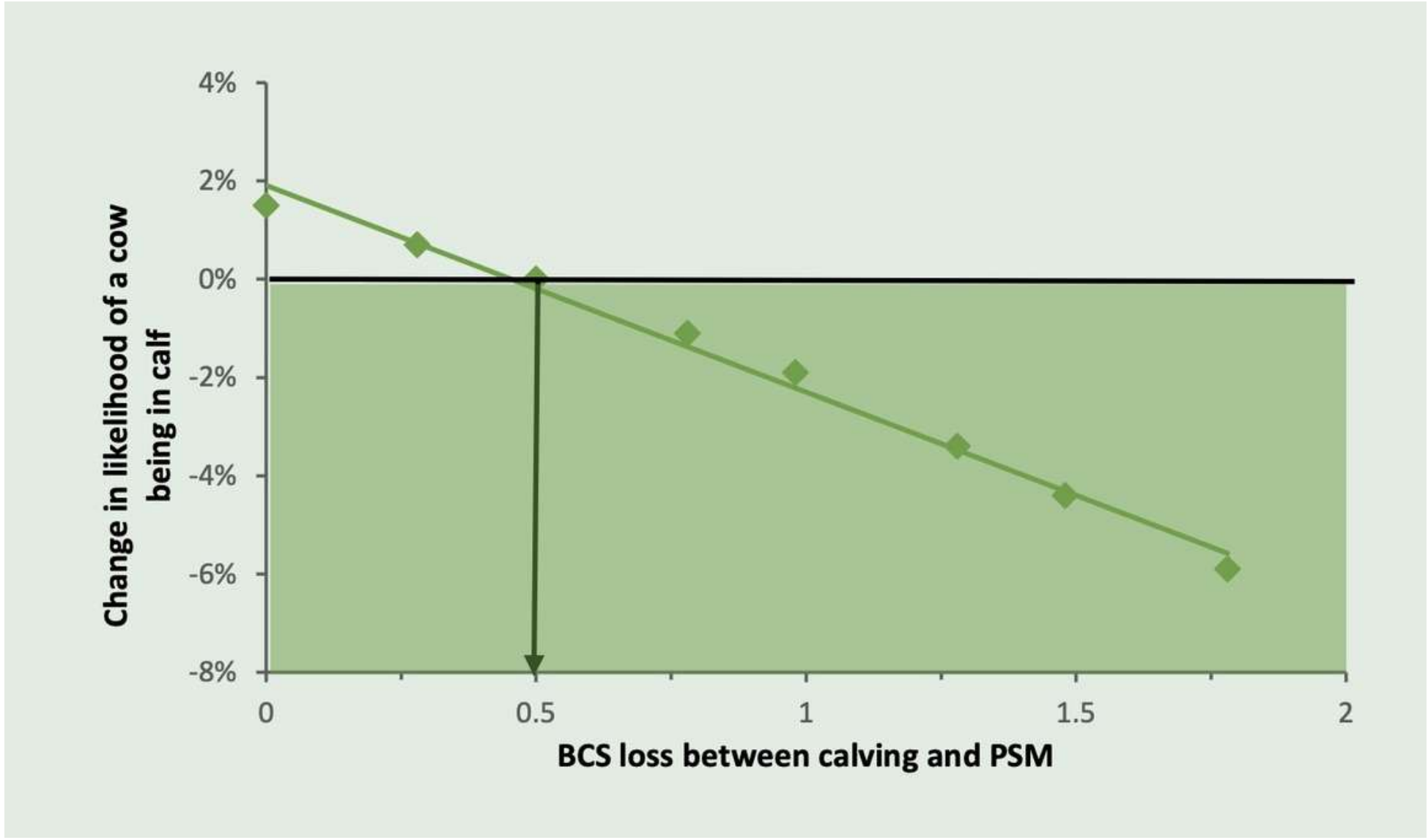
AMOUNT OF BCS LOSS POST-CALVING & MATING SUCCESS



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COW BREED & CONDITION LOSS POST-CALVING

Figure 10a: New Zealand

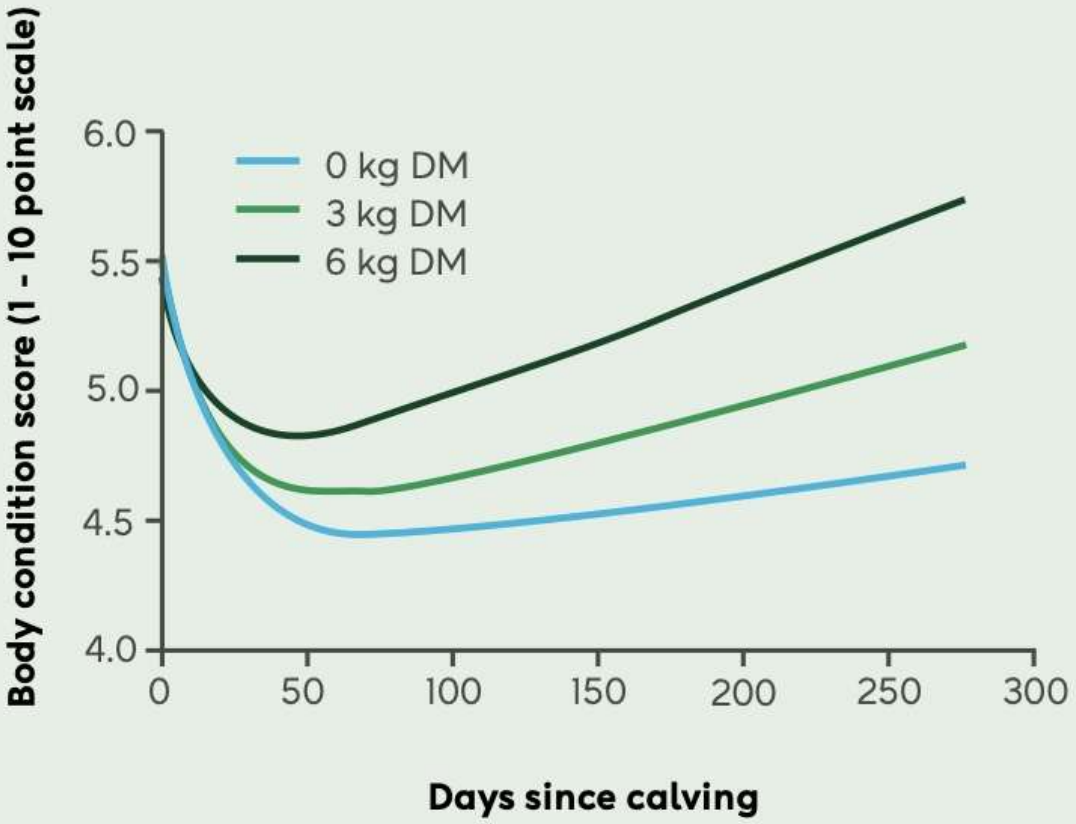
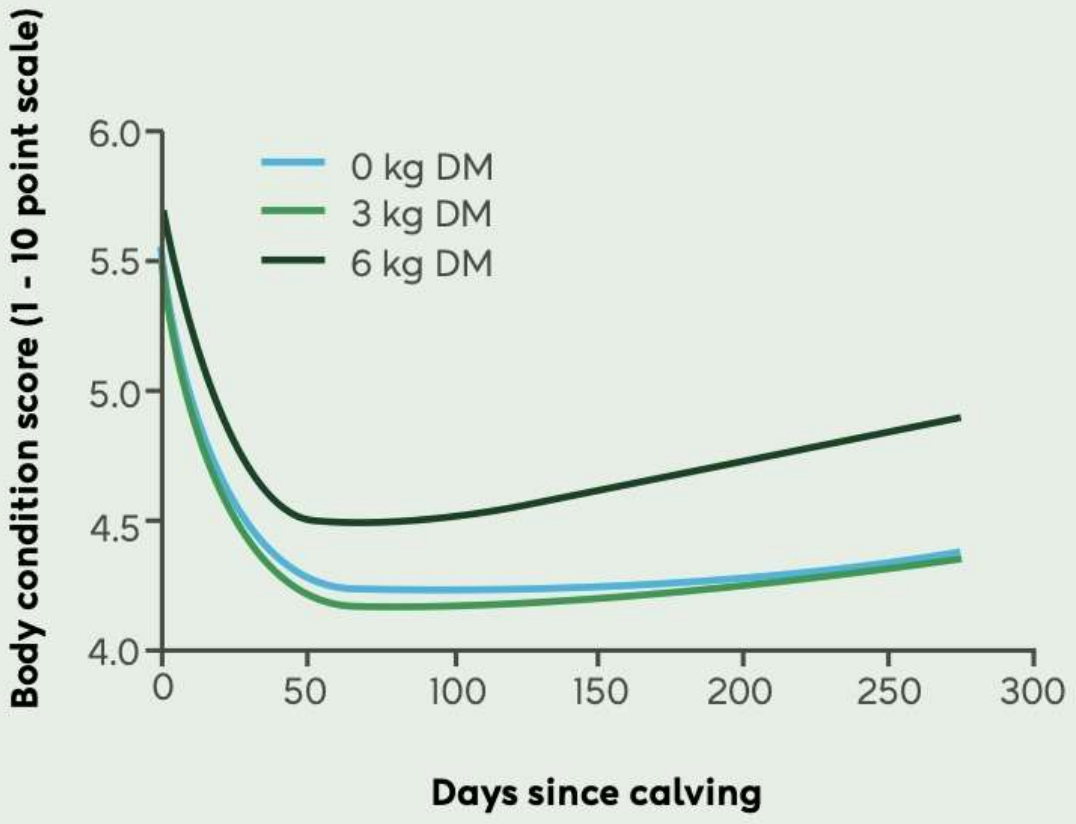


Figure 10b: North America



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PROTEIN STORAGE

- Cows store protein as amino acids in the muscle.
- At calving, cows meet up to 30% of their protein/amino acid requirements by mobilising muscle tissue. This is generally in response to a negative energy balance, where glucogenesis is overwhelmed and energy demand is propped up by gluconeogenesis.
- Muscle rich condition is critical for cow recovery post-calving. Having enough amino acids to mobilise helps to reduce ketosis/fatty liver risk.

FAT STORAGE

Unlike protein, fat is stored in multiple areas of the cow:

Subcutaneous
- Fat deposited beneath the skin, easily seen around the tail.

Intermuscular
- Fat between muscles.

Visceral
- Fat located around the liver, GIT, uterus, and heart.

WHY IS IT BEST TO START REBUILDING CONDITION EARLY

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Key factors:

1. It's critical that condition is not gained too quickly, as time influences fat deposition characteristics and metabolic risk at calving.

2. It's important no more than 0.5BCS is gained over the winter. If more condition is required, it must be built mid/late-lactation.

3. Giving first calvers time to grow and put on condition slowly is important.

WHAT ARE THE KEY METABOLIC DRIVERS FOR CONDITION GAIN?

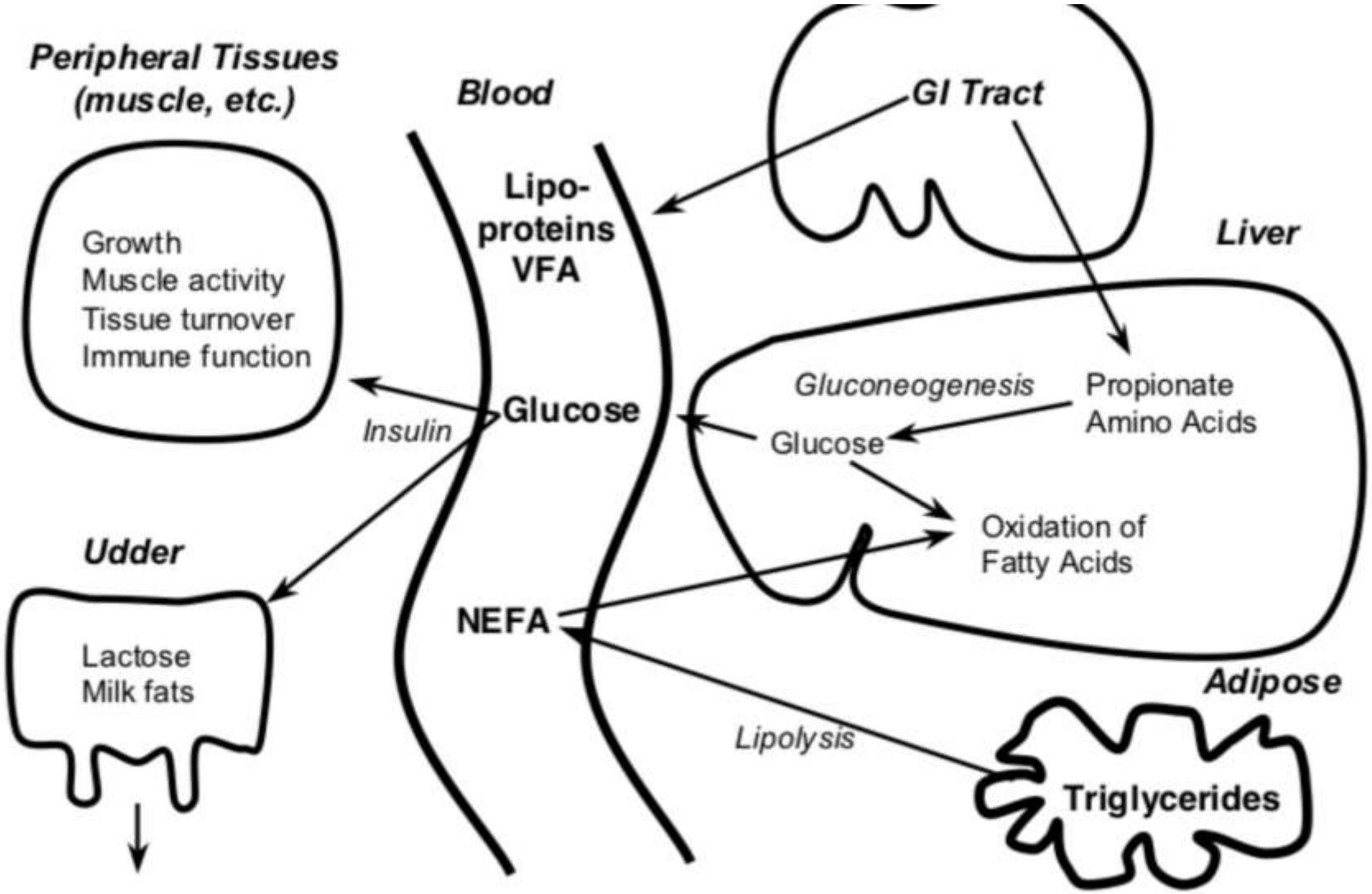

Figure 4. Schematic of glucose metabolism in a normal dairy cow.

WHAT ARE THE KEY METABOLIC DRIVERS FOR CONDITION GAIN?

Quality feed

Excess glucose for adipose & muscle growth

Sufficient energy

Sufficient protein

Insulin sensitivity

Excess glucose to milk requirement

Condition gain NOT mobilisation

Sufficient glucogenesis/ gluconeogenesis

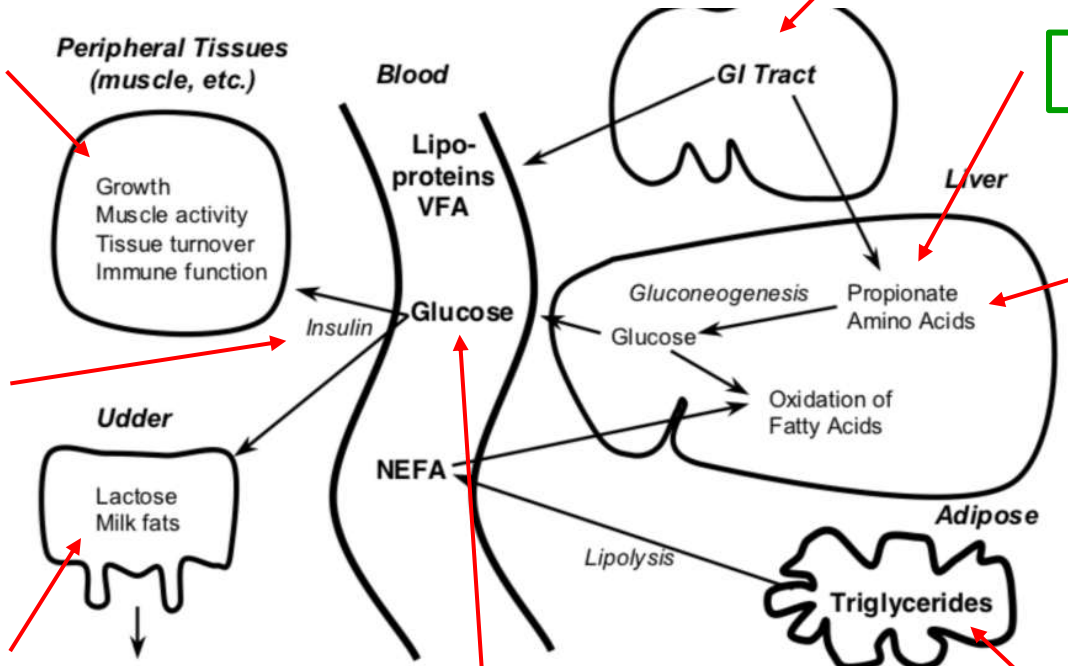

Figure 4. Schematic of glucose metabolism in a normal dairy cow.

BEST ENERGY SOURCES FOR CONDITION GAIN

- Feeding metabolisable energy excess to requirements
- Calculate feed allocations for cow condition growth
- High fat%, protein:fat ratio below 0.8 in the milk - indicating a ‘cooler’ diet
- A ‘cooler’ diet will favour cow condition gain
- Slower fermentation starchs, i.e. barley favours cow condition gain

BEST ENERGY SOURCES FOR CONDITION GAIN

- PKE can supply higher levels of C16 and C18:1 fatty acids, which help drive insulin and glucogenesis.
- Starch can also help to utilise excess protein, getting the balance right can mean better appetite, more milk, and better LWT gain with less kg DM fed.
- Rumen by-pass fats can also be useful for holding/building cow condition, particularly in times of stress or when targeting cows/genetics.
- Live yeast helps to maintain rumen stability and increase the capacity of the fibrolytic bacteria is digesting high-fibre diets.

ENSURE PROTEIN LEVELS ARE SUFFICIENT

- Excess protein is not generally an issue in the autumn, but can be in the summer months.
- >14% CP generally required for balance LWT gain.
- CP is made up of non-protein-nitrogen (NPN) and complex protein (amino acids etc.).
- The amount of protein, along with quality, is important.
- Watch for excess protein/high MU levels - >30 when production is below 1.75kg MS.

KEY MINERAL GAPS TO ENSURE ARE NOT LIMITING CONDITION GROWTH

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Copper, zinc, manganese

- Important for reducing wasted energy
- Reduced oxidative stress

Selenium

- Liver and immune performance

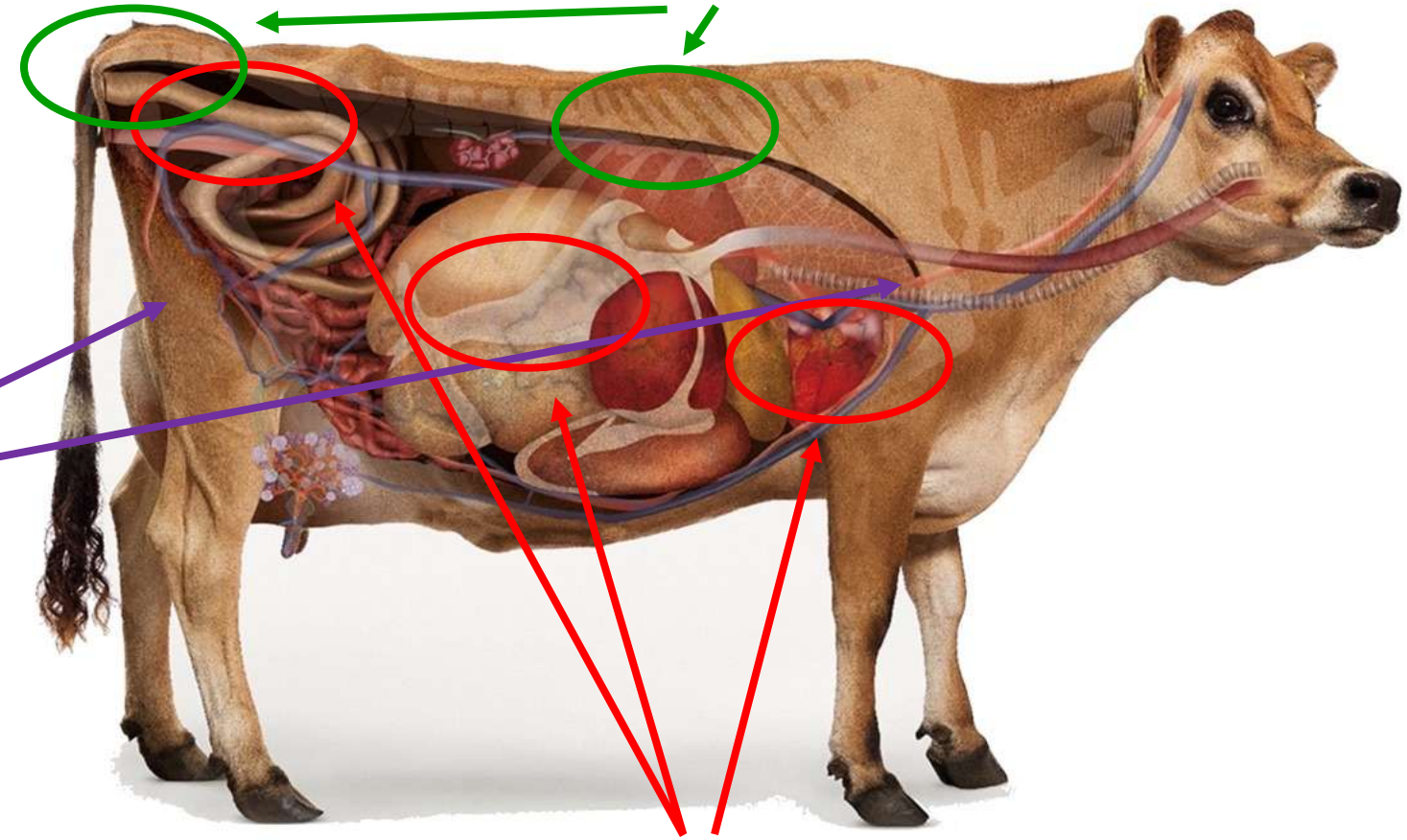
Chromium

- Increases insulin sensitivity
- Improves energy partitioning to cow condition
- 6 – 9mg/cow/day

Live yeast

- Rumen stability
- Increased fibre digestion

STORED FAT DISTRIBUTION IN COW



TYPES OF FAT & ITS EFFECT AT CALVING

Subcutaneous fat

- Fat stored under the skin.
- Richer in unsaturated fatty acids than visceral fat.
- Takes longer to build.

Visceral/abdominal fat

- Stored around GIT, kidney, liver, and uterus.
- More responsive and dynamic than subcutaneous fat.
- Increased up-regulation of lipolysis.
- Fast-on/fast-off.
- Linked to higher NEFA and lower insulin concentrations.
- Lower insulin sensitivity due to higher adiponectin expression.
- Higher risk for ketosis/fatty liver.

Muscular Fat – Inter & intra

- Stored in-between muscles and within muscles.
- Fast-on/fast-off, dynamics are less researched.
- Lower volume, of less importance than subcutaneous and visceral fat.

Melendez et al., 2024
Ghaffari et al., 2023

UNSATURATED VS SATURATED STORED FAT DYNAMICS

Table 2. Fatty acid composition (g/100 g of FA) of the 3 main fat compartments in dairy cows suffering from a left displacement of the abomasum[1]

	Compartment				
Item	Abdominal	NEFA	Subcutaneous	SEM	*P*-value
Fatty acid					
14:0	2.52[a]	1.80[b]	3.03[c]	0.098	<0.0001
14:1 *cis*-9	0.22[a]	0.30[a]	1.57[b]	0.090	<0.0001
16:0	24.7[a]	22.0[b]	25.2[a]	0.48	<0.0001
16:1 *cis*-9	1.30[a]	2.02[a]	6.07[b]	0.255	<0.0001
18:0	26.6[a]	20.1[b]	11.0[c]	0.61	<0.0001
18:1 *cis*-9	31.1[a]	26.2[b]	37.9[c]	0.79	<0.0001
18:1 *trans*-11	1.97[a]	2.14[ab]	2.31[b]	0.100	<0.0001
18:2 *cis*-9,*trans*-11	0.272[a]	0.288[a]	0.644[b]	0.0459	<0.0001
18:2n-6	0.94[a]	3.02[b]	0.87[a]	0.107	<0.0001
18:3n-3	0.31[a]	0.72[b]	0.27[a]	0.022	<0.0001
Summation[2]					
SFA	53.9[a]	44.0[b]	39.3[c]	0.84	<0.0001
MUFA	34.6[a]	30.7[b]	47.9[c]	0.97	<0.0001
PUFA	1.52[a]	4.02[b]	1.79[a]	0.117	<0.0001
Δ^9-Desaturase index[3]					
C14-ratio	0.088[a]	0.167[b]	0.505[c]	0.0274	<0.0001
C16-ratio	0.054[a]	0.091[b]	0.242[c]	0.0107	<0.0001
C18-ratio	1.22[a]	1.37[a]	4.17[b]	0.172	<0.0001
Total FA content	56.9		48.4	2.99	0.006

[a–c]Values with different subscripts in the same row significantly differ ($P < 0.05$).

[1]Values are model least squares means.

[2]SFA= 14:0 + 16:0 + 18:0; MUFA = 14:1 *cis*-9 + 16:1 *cis*-9 + 18:1 *cis*-9 + 18:1 *trans*-11; PUFA = 18:2 *cis*-9, *trans*-11 + 18:2 n-6 + 18:3 n-3.

[3]C14-ratio = 14:1 *cis*-9/14:0; C16-ratio = 16:1 *cis*-9/16:0; C18-ratio = 18:1 *cis*-9/18:0.

Hostens et al., 2012

FACTORS INFLUENCING FAT DISTRIBUTION

Dietary factors

- Over-conditioning of cows during the late lactation and dry period.
- Fast weight gain due to diets that are too energy-rich, easily fermentable.
- During the dry period higher fibre diets are important. Stay away from highly fermentable feeds such as starch or soluble sugar.
- Ensure adequate protein balance, supplying the full range of amino acids.
- The more your cows produce during lactation, the more sensitive they are to higher levels of abdominal fat deposition/mobilisation.

Cow genetics

- Garcia-Roche et al., 2023 showed significant differences between fatty acid concentrations and deposition in NZ Holsteins vs US Holsteins.
- As cows get more genetically productive, they tend to have higher abdominal fat deposits pre-calving, becoming higher risk.

Melendez et al., 2024
Contreras et al., 2018
Martins et al., 2011
Garcia-Roche et al., 2023
Meier et al., 2013
Ghaffari et al., 2023

DETERMINING SUB-CUT VS ABDOMINAL FAT DEPOSITS

Hard to do! Raschka et al., 2016 have developed an ultra-sonographic technique, but its practicality is limited:

Visual and hands-on assessments

- Fat assessment can be made visually over different parts of the cow
- Hard to get accurate proportions
- Back fat vs muscular mass may be useful?

Melendez et al., 2024 found little association with visual body condition score and the amount of visceral fat in Jersey dairy cows.

More info to come!

Melendez et al., 2024
Ghaffari et al., 2022

ANIMAL HEALTH IMPLICATIONS OF FAT DISTRIBUTION

- Lipolysis increases inflammation via cytokine release
- Increased lipolysis rates increase inflammation
- Upsetting calcium and magnesium signaling, increasing metabolic risk

- Mobilisation of abdominally stored fat produces more inflammatory factors than subcutaneous fat mobilization.

- This inflammation is likely localised to where the fat is mobilised from. This is particularly important for the liver, uterus, and GIT.

- Cows suffering from ketosis and fatty liver had lower calcium, potassium, magnesium, selenium, manganese, boron & molybdenum blood levels.

- High-production cows under ketosis/fatty liver burden respond less to GH, upsetting IGF-1 synthesis, which effects reproductive function.

- Increased inflammation and ketosis also make insulin resistance worse and reduce immune system function, increasing metritis and mastitis incidence.

Melendez et al., 2024 Ghaffari et al., 2023
Contreras et al., 2018 King et al., 2021
Zhang et al., 2024

Key points

- Ensure >12% CP in diet over the dry period, ideally 14% CP. Quality protein is also important.
- Building cow condition gradually from mid-lactation may result in better fat type distribution, translating into better metabolic outcomes at calving.
- Best practice is to not gain any more than 0.5BCS during the dry period.
- The diet during the dry period has a big impact on the type of fat deposited.
- Avoid highly fermented energy sources within 90 days of calving - less WSC/sugar and starch, more complex carbohydrates (NDF).
- If you can manage your cows so they store more subcutaneous and muscular fat and less visceral fat, this will translate into better milk production, less condition loss, and less animal health issues post-calving, along with better reproductive success.

THANK YOU FOR ATTENDING

For more information and previous webinars:

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- Call me on: 021644035