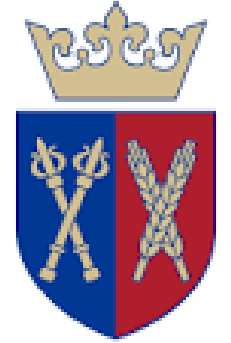




Performance of preweaning dairy calves fed milk replacer supplemented with increasing doses of ethyl esters of polyunsaturated fatty acids of linseed oil



**Mohammed K. Baba *, Jadwiga Flaga, Kinga Dziadek,
Katarzyna Dudek and Zygmunt M. Kowalski**

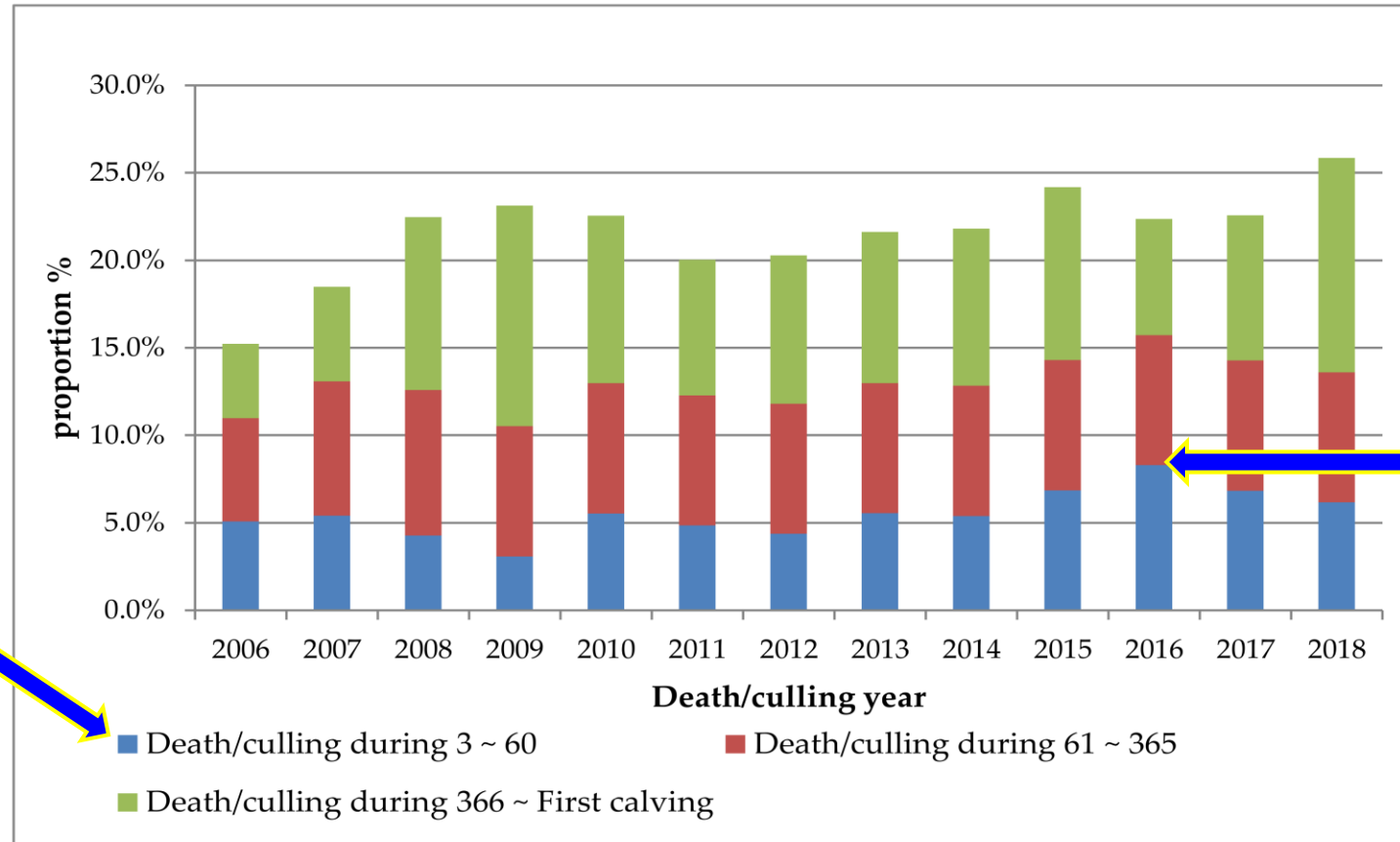
- Presenting author
- Abstract #73047544

Department of Animal Nutrition and Fisheries
University of Agriculture in Krakow
Krakow, Poland



**3rd EAAP Regional Meeting
Animal Production in the Changing World
Krakow, Poland**

Introduction



Morbidity and mortality of calves are still a challenge in the dairy herd

Up to around 8% Removed due to death or disease

Zhang et al., 2019

Introduction

The early life stages of dairy calves play a critical role in their health, future yield, and longevity in the cattle herd (van Niekerk et al., 2021)



Healthy & strong calf



Matured dairy heifers



Milking parlour filled with cows including new heifers



Introduction



Sick and weak calf (morbidity)



Overcome by disease and died (mortality)



Empty milking parlour



Calves are faced with calving stress, gastrointestinal, respiratory diseases along with environmental and dietary problems (Lorenz et al., 2010)

Retarded growth and health that has negative impacts on their future productivity and farm income (Soberon and van Amburgh 2013; Fabianowska et al., 2023)

Introduction

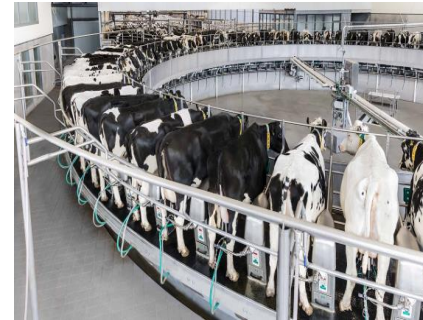
Proper nutrition including the use of PUFA can solve the problem due to its anti-inflammatory and antioxidative benefits



Calves feeding with milk replacer enriched with source of polyunsaturated fatty acids (PUFA)



Increased immunity, antioxidants and health



Milking parlour filled with cows including new heifers

Research results suggest that PUFA enrichment can proffer beneficial effects to the health, growth performance, and the resilience to diseases in calves (Karcher et al., 2014; Flaga et al., 2019; Melendez et al., 2022; Baba et al., 2024)



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Fatty acid intake alters growth and immunity in milk-fed calves

T. M. Hill,^{*1} M. J. VandeHaar,[†] L. M. Sordillo,[‡] D. R. Catherman,[§] H. G. Bateman II,^{*} and R. L. Schlotterbeck^{*}

^{*}Nurture Research Center, ProVim North America, Lewisburg, OH 45338

[†]Department of Animal Science, and

[‡]Department of Large Animal Clinical Sciences, Michigan State University, East Lansing 48824

[§]Strauss Feeds, Watertown, WI 53098



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Effect of supplementing essential fatty acids to pregnant nonlactating Holstein cows and their preweaned calves on calf performance, immune response, and health

M. Garcia,^{*} L. F. Greco,^{*} M. G. Favoreto,^{*} R. S. Marsola,^{*} D. Wang,^{*} J. H. Shin,^{*} E. Block,[†] W. W. Thatcher,^{*}

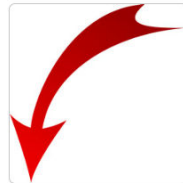
J. E. P. Santos,^{*} and C. R. Staples^{*1}

^{*}Department of Animal Sciences, University of Florida, Gainesville 32608

[†]Arm and Hammer Animal Nutrition, Princeton, NJ 08543



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Effects of n-3 fatty acids on growth, antioxidant status, and immunity of preweaned dairy calves

K. Śpitalniak-Bajerska,¹ A. Szumny,² K. Pogoda-Sewerniak,¹ and R. Kupczyński^{1*} 

¹Department of Environment Hygiene and Animal Welfare, Faculty of Biology and Animal Science, Wrocław University of Environmental and Life Sciences, 51-630 Poland

²Department of Chemistry, Wrocław University of Environmental and Life Sciences, 51-630 Poland

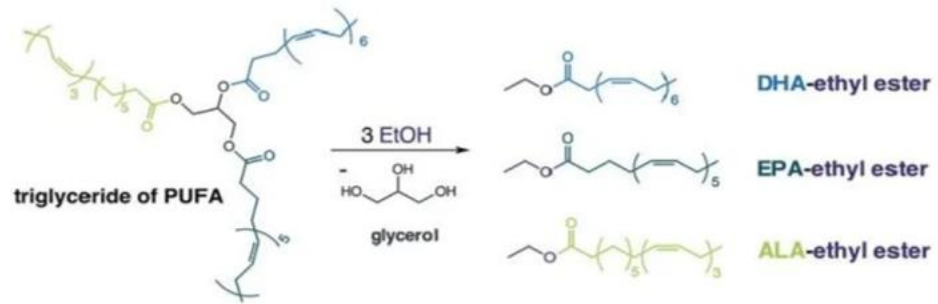
Studies on feeding of PUFA to calves in oil form; biohydrogenation and stability are the concern



A study on ethyl esters of PUFA of linseed oil (EPUFALO)
Limited by few animals and confounding effect of dried apples



Introduction



Reaction of trans-esterification of triglyceride and ethanol

Introduction

Oils vs. EEPUFA as feed additives for calves

Oils

Not easily mixed/blended
with milk replacer

Biohydrogenation

May contain other substances,
e.g. toxic alkaloids

Proportion of FA not easily
modified

EEPUFA

Easily mixed/blended
with milk replacer

No biohydrogenation

Contain only FA

Proportion of FA can be
easily modified

Hypothesis and objectives

- We hypothesized that
 - adding EEPUFALO to milk replacer will promote the health and performance of pre-weaned dairy calves, and
 - the effects depend on the dose of EEPUFALO
- The objective of the study was to determine the health and performance of pre-weaned dairy calves fed MR containing increasing doses of EEPUFALO



Source of
PUFA



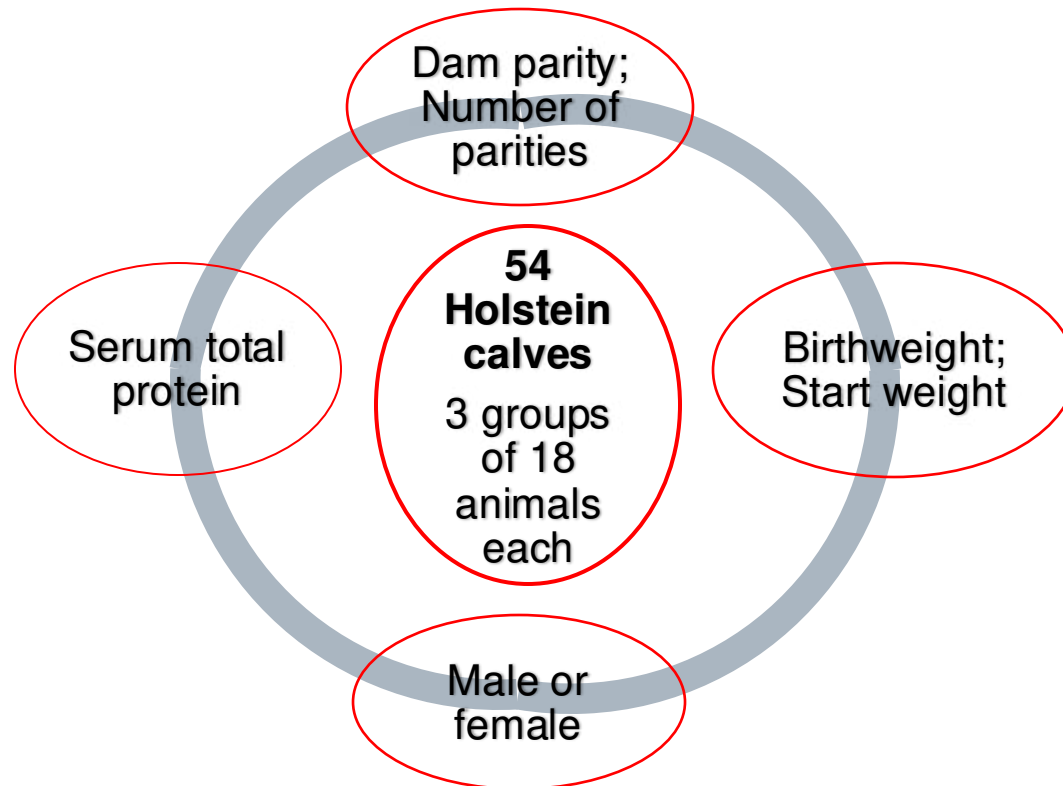
Improved
health,
performance,
and immunity



Milking
parlour filled
with cows
including new
heifers

Materials and methods

- Approved by local ethics committee in Krakow, Poland
- Experiment conducted at a commercial farm



Materials and methods

Milk replacer
+ 0 ml/d of EEPUFALO



Milk replacer
+ 15 ml/d of EEPUFALO



+



Milk replacer
+ 30 ml/d of EEPUFALO



+



Materials and methods

- **Feed intake**

From 5 to 56 days of life

Control of feeds (milk replacer and calf starter) served and refused (**checked everyday**)

- **Health status**

Number of animals sick, fecal scores (1-4 points), number of days receiving treatment, days when sick (**checked everyday**)

- **Body weights and measurements**

Body weight (kg), body weight gain (g), hip width, hip height, heart girth, and withers height (cm) (**checked weekly**)



Materials and methods

Statistical analysis

Proc Glimmix of SAS (2013)

$$Y_{ijk} = \mu + G_i + T_j + GT_{ij} + \varepsilon_{ijk} \quad (1)$$

where Y_{ijk} was the dependent variable; μ was an overall mean; G_i is the group effect (3 groups); T_j (sampling time); GT_{ij} was the group effect $\times$ time, and ε_{ijk} was the random residual error

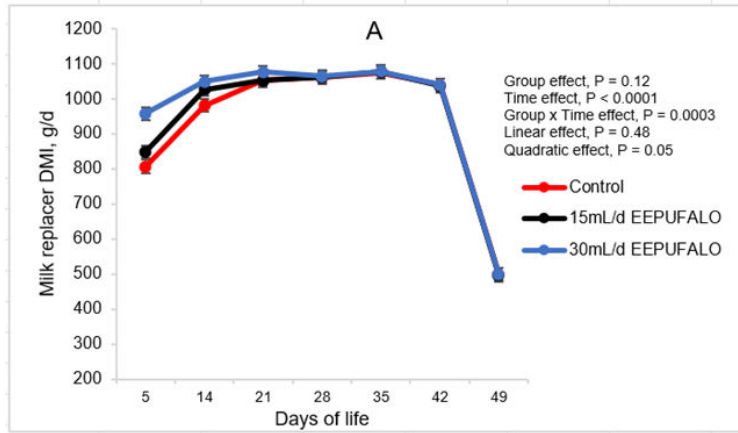
$$Y_{ij} = \mu + G_i + \varepsilon_{ij} \quad (2)$$

where Y_{ij} was the dependent variable; μ was an overall mean; G_i is the group effect (3 groups); and ε_{ij} was the random residual error

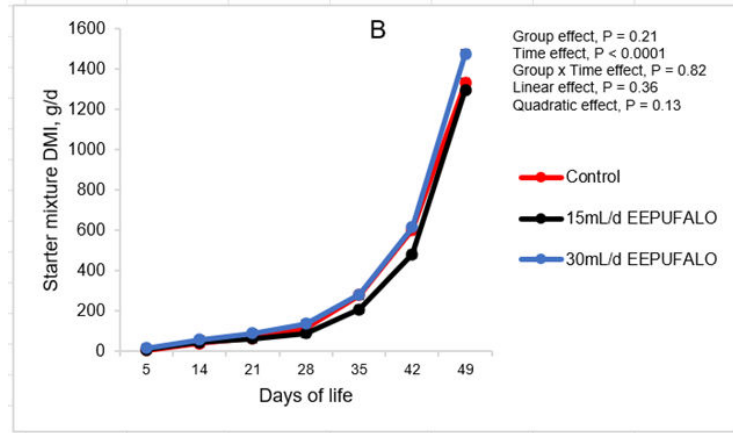
Kruskal Wallis test (3) performed for health indicators parameters



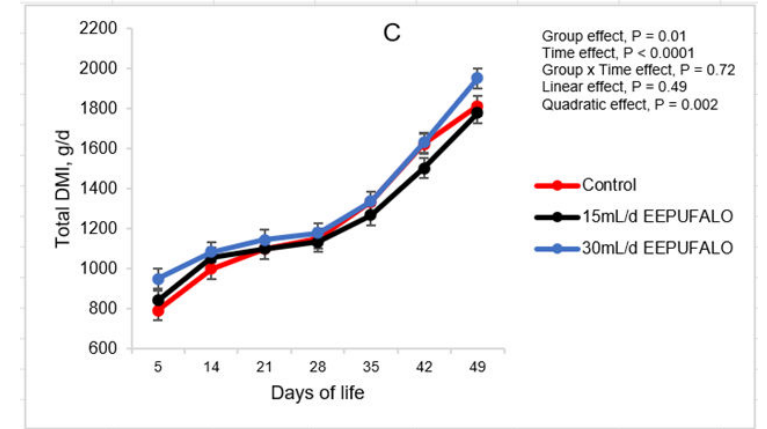
Results



Milk replacer DMI, g/d



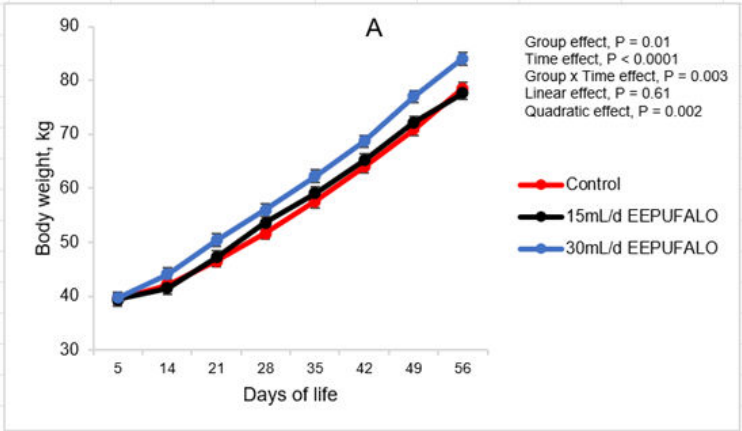
Starter DMI, g/d



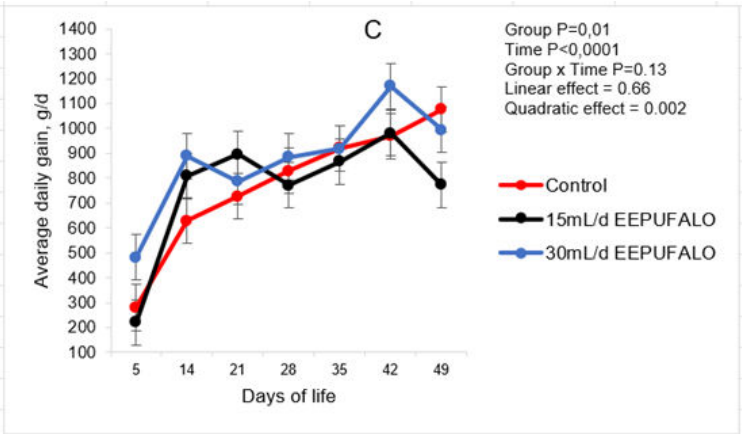
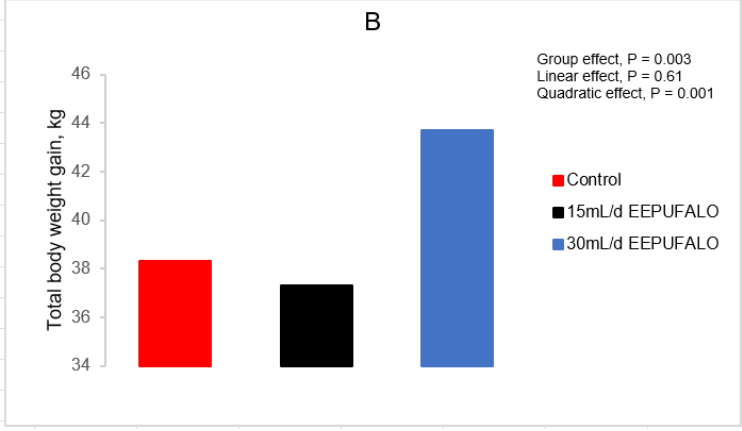
Total DMI, g/d

Results

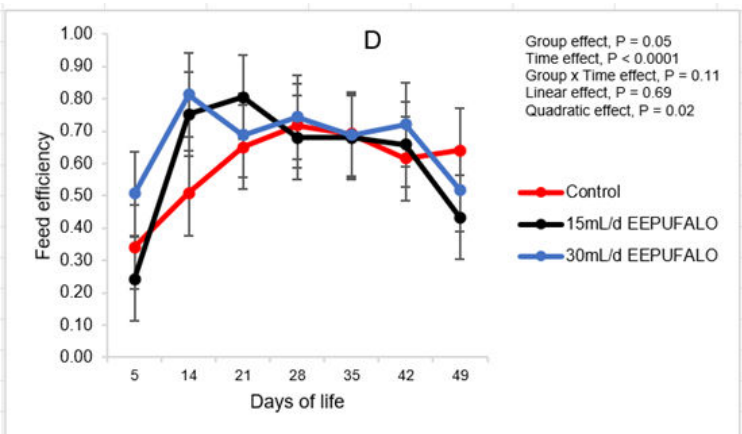
Body weight, kg



Total body weight gain, kg



Daily body weight gain, kg



Feed efficiency, gain/intake

Table 1. Least square means of the effects of ethyl esters of polyunsaturated fatty acids of linseed oil (EPUFALO) supplemented to milk replacer (MR) on feed intake, growth and morphometric measurements of dairy calves.

Items	Groups ¹			SEM ²	Effects, P-value			Polynomial contrasts, P-value	
	Control	D1	D2		Group	Time ³	Group x Time ⁴	Linear	Quadratic
Initial hip height, cm ⁵	82.15	83.14	82.38	0.76	0.58			0.32	0.76
Final hip height, cm ⁵	95.24	95.36	96.63	0.46	0.04			0.84	0.01
Total hip height gain, cm ⁵	12.89	12.23	14.20	0.71	0.10			0.47	0.04
Initial hip width, cm ⁵	17.15	17.13	17.41	0.31	0.74			0.97	0.44
Final hip width, cm ⁵	21.25	21.27	21.85	0.20	0.04			0.94	0.01
Total hip width gain, cm ⁵	4.05	4.14	4.42	0.36	0.71			0.85	0.42
Initial heart girth, cm ⁵	78.88	78.91	79.61	0.51	0.46			0.96	0.21
Final heart girth, cm ⁵	98.64	99.27	102.11	0.72	< 0.0001			0.50	< 0.0001
Total heart girth gain, cm ⁵	19.56	20.37	22.44	0.79	0.02			0.43	0.01
Initial withers height, cm ⁵	78.72	79.88	78.33	0.75	0.27			0.24	0.26
Final withers height, cm ⁵	90.11	91.50	92.66	0.60	0.01			0.08	0.01
Total withers height gain, cm ⁵	11.18	11.63	14.28	0.73	< 0.0001			0.65	< 0.0001
Hip height gain, cm/week ⁶	1.85	1.75	2.03	0.09	0.09	0.88	0.61	0.46	0.04
Hip width gain, cm/week ⁶	2.78	2.91	3.20	0.11	0.73	< 0.0001	0.93	0.79	0.46
Heart girth gain, cm/week ⁶	0.59 ^b	0.61 ^{ab}	0.64 ^a	0.05	0.02	0.01	0.12	0.38	0.01
Withers height gain, cm/week ⁶	1.60 ^b	1.65 ^b	2.04 ^a	0.10	0.004	0.08	0.64	0.75	0.001

¹ Control – no EPUFALO, D1 – 15 mL of EPUFALO/d supplemented to MR, D2 – 30 mL of EPUFALO/d supplemented to MR.

² SEM - Standard error of means.

³ Days of life of the calves.

⁴ Interaction Group x Time.

⁵ Data subjected to the analysis of variance without repeated measures of time.

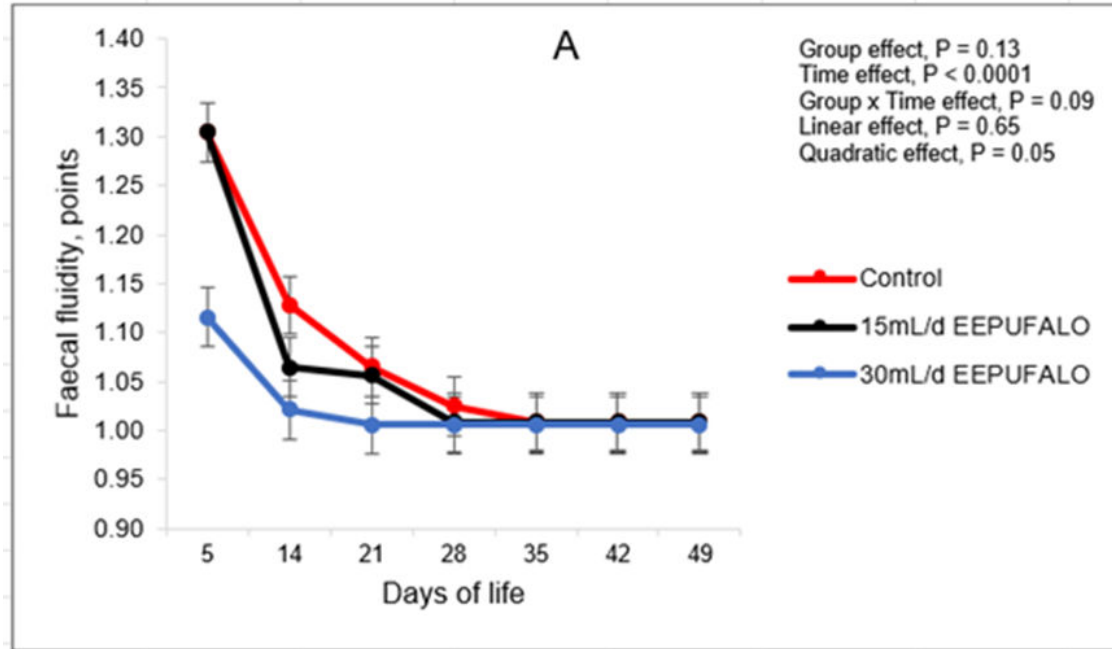
⁶ Data were subjected to the analysis of variance with repeated measures of time.

⁷ Calculated as the ratio of average daily gain, g/d to average daily total DMI, g/d.

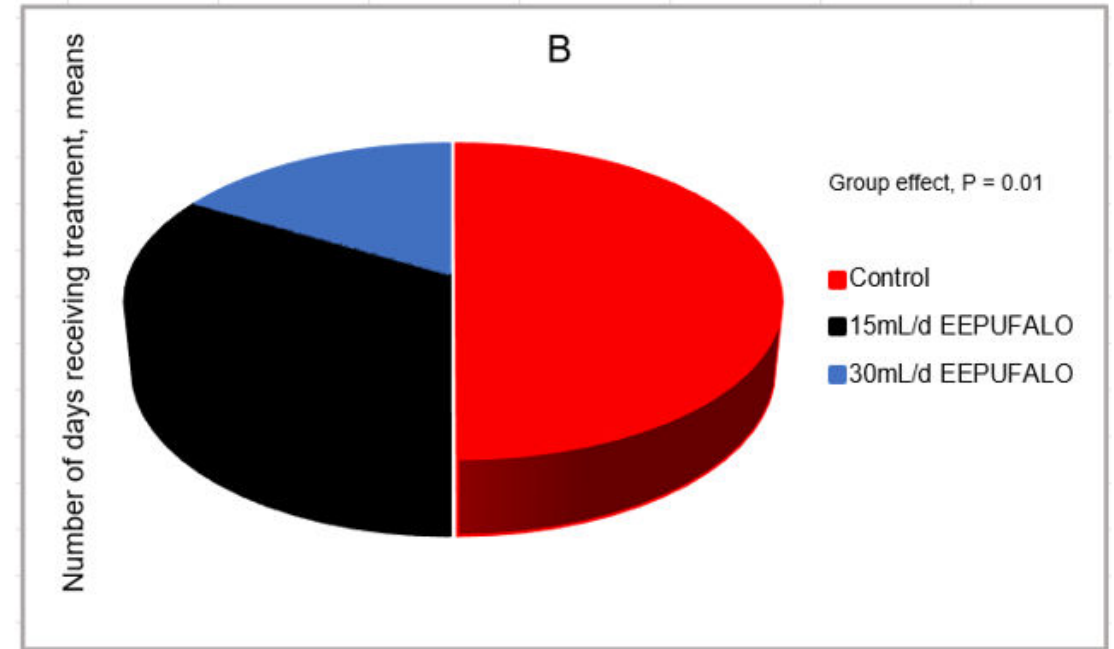
^{a, b} LSM means marked by different superscripts differ at $P < 0.05$ and tendencies at $0.05 < P < 0.10$.

Results

Fecal fluidity, points



Number of days receiving treatments, means



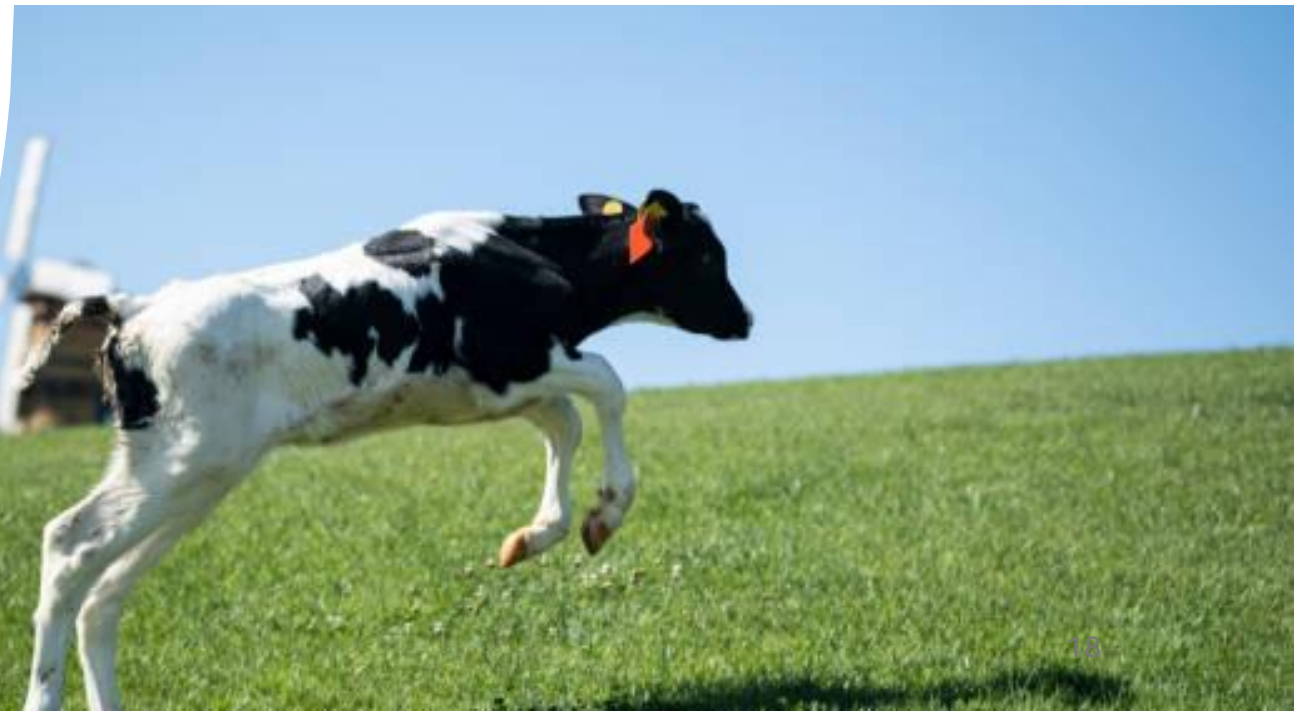
Conclusion

The addition of up to 30 mL/d of EEPUFALO to the milk replacer of dairy calves proves to enhance their health and performance

Research Team

M. K. Baba^{1,2}, J. Flaga¹, K. Dziadek³, K. Dudek⁴, Z. M. Kowalski¹

¹ University of Agriculture in Krakow, Department of Animal Nutrition and Fisheries,, Al. A. Mickiewicza 24/28, 31-059 Krakow, Poland, ² Nasarawa State University Keffi, Department of Animal Science, Faculty of Agriculture, Shabu-Lafia Campus, 911019 Keffi, Nigeria, ³ University of Agriculture in Krakow, Department of Human Nutrition and Dietetics, Balicka 122, 30-149 Krakow, Poland, ⁴ National Veterinary Research Institute, Department of Cattle and Sheep Diseases, 57 Partyzantow Avenue, 24-100 Pulawy, Poland



Thank you for your
attention!