





Heritabilities ( $h^2$ ) for methane production in sheep have been reported at  $h^2 \sim 0.29$  for gCH<sub>4</sub>/day, 0.13 for gCH<sub>4</sub>/kg feed measured in respiration chambers (Pinares-Patino *et al.* 2013) and  $\sim 0.1$  for gCH<sub>4</sub>/day adjusted for LWT measured in PACs (Robinson *et al.* 2014). Given the low to moderate heritabilities for methane related traits, the repeatability, which is the upper limit for the heritability, was expected to be moderate.

**Repeatability with treatments.** This study established that short term repeatabilities, measured within 3 days, for CH<sub>4</sub> adjusted for LWT were moderate for ewes at yearling age ( $r(T1)=0.33\pm 0.09$  and  $r(T2)=0.37\pm 0.09$ ). During lactation the repeatabilities were moderate ( $r(T4)=0.40\pm 0.09$ ) to high ( $r(T3)=0.62\pm 0.06$ ). The increase in repeatability was due to higher between-animal and consequently phenotypic variance. In T5 all animals were only measured once and short term repeatabilities could not be established. The repeatability estimates were lower than repeatabilities from respiration chamber data on consecutive days ( $r = 0.94 \pm 0.003$ , Pinares-Patino *et al.* 2013), which demonstrates the influence of controlled feed intake and highlights the problematic adjustment for LWT, as was done in this study.

**Table 3. Repeatabilities and variances for CH<sub>4</sub> emission adjusted for LWT at different ages**

Treatment	Repeatability	V <sub>P</sub>	V <sub>Eg</sub>	V <sub>Es</sub>
T1 & T2	0.25 ± 0.07	0.027	0.007	0.020
T1 & T3	0.26 ± 0.06	0.039	0.010	0.029
T1 & T4	0.28 ± 0.05	0.047	0.013	0.034
T1 & T5	0.17 ± 0.05	0.029	0.005	0.024
T2 & T3	0.32 ± 0.08	0.034	0.011	0.023
T2 & T4	0.20 ± 0.05	0.043	0.009	0.034
T2 & T5	0.27 ± 0.06	0.026	0.007	0.019
T3 & T4	0.40 ± 0.07	0.057	0.023	0.034
T3 & T5	0.38 ± 0.06	0.037	0.014	0.023
T4 & T5	0.30 ± 0.06	0.047	0.014	0.033

**Repeatability across/between treatments.** Repeatabilities for CH<sub>4</sub> production adjusted for LWT across treatments, measured at least one month apart were low to moderate (Table 3). The estimates were lower than estimates reported by Pinares-Patino *et al.* (2013) of  $r=0.55\pm 0.02$  for gCH<sub>4</sub>/day, but align with estimates of  $r=0.25$  for gCH<sub>4</sub>/day adjusted for LWT measured in PACs reported by Robinson *et al.* (2014). Repeatabilities are slightly higher at later ages, which was due to an increase in between-animal variance.

Low repeatabilities indicated that the accuracy of CH<sub>4</sub> measurement with PACs on animals from pasture would benefit from repeated measures. As outlined earlier, CH<sub>4</sub> emission at T5 was assumed to be the representative trait of life time CH<sub>4</sub> emission. It was investigated if the measures at different treatments were appropriate to add as repeated measures to increase the accuracy of the phenotypic variance. The results in Figure 1 demonstrate that any of the other treatments are unsuitable as repeated measures to increase the accuracy of phenotypic variance for CH<sub>4</sub> production in T5. CH<sub>4</sub> production in lactating ewes (T3 and T4) added variance, mainly through an increase in the within-animal variance. This could indicate that CH<sub>4</sub> production adjusted for LWT is a different trait in dry and lactating ewes. It also demonstrates that LWT might not be an appropriate adjustment for feed intake. This makes sense because lactating ewes would eat more and produce more CH<sub>4</sub> compared to dry ewes at the same LWT. A small decrease in phenotypic variance was observed by combining T5 and T2, but the addition of either T2 or T1 decreased the between-animal variance, which again, might be a reflection of a smaller additive genetic variance for T1 and T2 than T5. Differences in magnitude of the CH<sub>4</sub> measurements between the

