

**Effects of Leaves Extract from *Spondias Mombin* L. and
Vitellaria Paradoxa Gaertn F. on West African Dwarf (WAD)
Sheep Performance in Republic of Benin**

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Effects of Leaves Extract from *Spondias Mombin L.* and *Vitellaria Paradoxa Gaertn F.* on West African Dwarf (WAD) Sheep Performance in Republic of Benin

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Abstract

This study considers effects of extract of *Spondias mombin* and *Vitellaria* (not *vitellaria*) *paradoxa* on milk production in WAD ewe and the growth performance of their lambs. For this purpose, 30 lactating ewes at their 2nd parity were selected and divided into 5 groups: a control i.e. without any treatment, *Spondias*-ethanol extracts, *Spondias*_methanol extract, *Spondias*_ethanol extract, *vitellaria*_ethanol extract and *vitellaria*_methanol extract. Each ewe received oral dose of 1.06 g of corresponding leaves extract for three (3) days at the beginning of lactation. The resulted outcomes indicate that ewes that received extract of *S. mombin* produce more milk (on the average 100.63g/day) than the control (92.90g/day) group and the one that received extract of *V. paradoxa* (91.51g/day). The extracts of *V. paradoxa* show no lactogenic activity compared to control and *Spondias* groups. Lamb weight gain was also higher ($p < 0.05$) than that in the control and *Vitellaria* groups. A weaning body weight of 9.62kg and 9.51kg had been obtained for lamb in *Spondias* groups against 8.67kg; 8.70kg and 8.72kg in *Vitellaria* groups and control group respectively. The type of solvent had no effect on milk production of ewe and growth performance of their lamb. The treatments did not influence body weight of ewe and milk conversion lamb.

Key words: Milk production, lactogenic plant, West African Dwarf sheep, *Spondias mombin*, *Vitellaria paradoxa*.

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Introduction

In recorded history, medicinal plants have been in use for the treatment of man and animal diseases (Osai, 1998). African women with milk production deficiencies traditionally use plant to induce milk production or to increase milk yield. Some plants have been identified as lactogenic because of a capacity to stimulate the synthesis of lactogenic hormones. The key hormone that initiates milk biosynthesis is prolactin (Vonderhaar, 1987), which exerts a direct effect on the mammary gland through prolactin receptors.

Milk is a food that is of great biological significance for lambs from the moment they are born from weaning. The West African Dwarf (WAD) ewe is a poor milker, kept exclusively for meat, as the ewe's milk yield barely suffices to feed the lambs. Hence, lamb mortality is high in this breed, on the average 20% (Gbangboché et al., 2005).

Nowadays, different plants found in nature are widely used in different fields including medicine, pharmaceuticals, food and health industries, but these plants are not widely used in veterinary. Considering the extensive utilization of *S. mombin* and *V. paradoxa* in traditional medicine, the present study was undertaken to investigate the effect of the extracts of *S. mombin* and *V. paradoxa* on milk production in lactating ewes and growth performance of the lambs.

Materials and Methods

Study environment

The Sheep production Centre of Bétécoucou is located in the "Zou Nord" department of central Benin, near the town of Dassa-Zoumè, between 7°45' and 07°50' North and 2°20' and 2°27' East and at 300 meters above sea level. The climate is of soudano-guinean type with a dry season from November up to March and a rainy season from April up to October. The average rainfall is 1,016 mm per year and the annual temperature ranges from 25°C to 30°C. The vegetation consists of wooded or shrubby savannas and grazed woodlands. Grass species characterizing these areas are *Brachiaria mutica*, *Panicum sp*, *Hyparrhenia smithiana*, *Sorghostum bipennatum*, *Indigofera*

hirsuta, *Pennisetum pedicellatum*, *Sporobolus pyramidalis*, *Andropogon gayanus*.

Preparation of extracts

Spondias mombin (anacardiaceae) and *Vitellaria paradoxa* (Sapotaceae) aerial parts (leaves) were collected respectively from Abomey-Calavi and Bohicon, in May 2010 and were identified in Laboratory of Applied Ecology (Faculty of Agronomic Sciences, University of Abomey Calavi, Benin). The fresh leaves of *V. paradoxa* and *S. mombin* are harvested, dried in the room at 22 ° C and then processed into powder using electric grinder. 60g of powder was soaked in 500ml of alcohol for 24 hrs at room temperature with occasional stirring. The content was filtered and evaporated to dryness using a water bath at 78°C. The extract was collected and stored in a refrigerator at 4°C until its use.

Management of animals

Thirty (30) lactating WAD ewes, at their second parity and weighting on average 15.5 ± 1.55 kg, were used in this experiment starting on the day of parturition and extended to 90 days afterward. Animals were housed at night and lambs were kept with their dams and remained with them until their weaning at three months of age. Lactating ewes were allocated into five groups (six animals each) and were assigned at random to receive one of the five treatments using complete randomized block design.

The treatments were a control i.e. without any treatment, spondias_methanol extract, Spondias_ethanol extract, vitellaria_ethanol extract and vitellaria_methanol extract received oral dose of 1.06 g of corresponding leaves extract diluted in 150 ml of water for three (3) days at the beginning of lactation. Animals under the control treatment received 150 ml of water.

The animals were conducted on artificial pasture consisting of *Panicum maximum C1*, *Brachiaria ruziziensis*, *Andropogon gayanus*, *Aeschynomene histrix* and *Cajanus cajan* from 11 AM to 17 PM. Back from the pasture, ewes received 300g of cotton seed cake per day and per animal, and occasionally, on-farm by-products such

as maize straw, rice straw and groundnut hay. Salt licks and water were provided *ad libitum*.

Data collection

For three months, milk production of ewes was estimated once every two weeks using a weigh-suckle-weigh (WSW) method: the method consists of weighing before and after suckling. On the eve of the collection date, lambs were isolated from their mothers at 18 hours pm. The next morning, lambs were weighed and then returned to their mothers and allowed to suckle for one hour. After suckling, lambs were weighed anew, then left to the pen and the ewes were sent to pasture. Back from the pasture, the WSW method was used again to assess the amount of milk suckled by the lamb. The sum of the first and second daily suckled milk gave an estimate of the amount of milk suckled per day per lamb. Total milk production of individual lactations was calculated from birth to weaning using the Fleischmann method (Boujenane, 1996) according the following equation:

$$Y = y_1 \times t_1 + \sum_{i=1}^{i=k-1} \left(\frac{y_i + y_{i+1}}{2} \times (t_{i+1} - t_i) \right)$$

Where Y is total milk production, y_1 , y_i are suckled milk at first and i th days ($k=1 \dots k-1$), t_1 and t_i are times (in days) from weaning to i^{th} test day.

The birth weight of lambs and subsequent weights at every two weeks were recorded. Every two weeks, lambs were weighed before feeding in the morning. Average daily gain (ADG) of lambs was calculated to compare the growth of lambs between treatments. The ewes' body weight was measured once a month. Body weight gain and suckled milk are typically used to measure milk efficiency calculating milk conversion lamb (MCL). Milk conversion lamb (MCL) for each individual lamb was also calculated from suckled milk and weight gain (suckled milk /Average daily gain).

Statistical Analysis

The means and standard errors of the means of milk production as well as those of ADG were determined. Statistical analysis of the differences between mean values obtained for treatments was performed using Minitab. Data were subjected to one way analysis of variance (ANOVA) followed

by Tukey- Kramer multiple comparison test. In all cases, p values ≤ 0.05 were regarded as statistical significance.

Results and Discussion

Milk production

From the first week up to the eighth week of lactation, the daily suckled milk for Spondias groups is higher than control and Vitellaria groups (Figure 1). From the eighth to the end of lactation, the daily suckled milk is similar on all groups. The regression coefficient ($r \leq -0.96$) shows that the milk production is highly predicted by the lactation curves (Table 1). The table3 of analysis of variance of groups shows that the daily suckled milk and total suckled milk were significantly higher ($p < 0.05$) in the ewes of Spondias groups than Control and Vitellaria groups ($p < 0.05$), but comparable on control and Vitellaria groups (Table 3). The daily suckled milk were 101.14; 100g/day and 90.89; 92.13; 92.90g/day for Spondias groups and Vitellaria; control groups, respectively (Table3).

However, the type of solvent used for extraction had no effect on daily suckled milk of lamb (figure3).The sex of the lamb had also not significant effect on milk production ($p > 0.05$) (Table2).

Body weight of lamb and ewe

The body weight of lambs increased gradually and similarly for all groups during the first 2 week (Figure 2). After the first two weeks, this increase is much more pronounced in the lambs of Spondias groups (body weight > 9.50 kg) than others groups (Body weight < 9 kg). Analysis of variance (Table3) shows that the birth body weight of lambs is similar on all groups ($p > 0.05$). However, the body weight at weaning and average daily gain (ADG) was significantly higher in the lamb of the Spondias groups (88.58 and 86.80g/day) than Vitellaria groups (70.34; 74.29g/day) and Control group (74.51g/day) ($p < 0.05$) (Table3). The growth performance of lamb was comparable in Vitellaria and control groups. It was also being noticed that the type of solvent used for extraction had no effect on average daily gain of lamb (Figure 4).

The sex of the lamb had no significant effect on body weight, average daily gain (ADG) of lamb ($p > 0.05$) (Table 2). Also the treatments and sex of lamb had no effect on initial and final body weight of ewe ($p > 0.05$) (Table 2 and 3).

Milk Conversion Lamb (MCL)

MCL was decreased progressively in lambs and is similar in all groups from birth to weaning. Analysis of variance (Table 4) show that average of MCL and MCL in 0 – 15 days, 15 - 30 days, 45 – 60 days, 60 - 75 days and 75-90 days were comparable in five groups ($p > 0.05$). However in 30 - 45 days, MCL was significantly higher in the lambs of *Vitellaria* groups and control than *Spondias* groups ($p < 0.05$). The MCL were 1.02 in *Spondias* groups against 1.05; 1.07 in *Vitellaria* groups and 1.04 for control group. As for the effect of sex and type of solvent used for extraction on the MCL (Table 2 and figure 5), it seems that the sex of the lamb and type of solvent had no effect on MCL ($p > 0.05$).

The results of the milk production show that, the treatments based extracts of *S. mombin* stimulated milk production in treated ewes. The daily suckled milk was 101.14; 100g/day *Spondias* groups, against 90.89; 92.13g/day for *Vitellaria* groups; 92.90g/day for control (Table 3). Lactogenic activity of *S. mombin* leaves has already been reported by Akouedegni (2012) in Republic of Benin and Oguike (2008) in Nigeria. Lactogenic activity of the extracts of *S. mombin* be due to the ability of leaves to stimulate the hormones that initiate milk biosynthesis (Houdebine, 2007) and causing development of breast tissue (Lompo-Ouedraogo, *et al.* 2004). Literature indicates that there are many medicinal plants with lactogenic effect. In women, *Trigonella foenum graecum* and *Silbanum marianum* are most often used to increase milk supply (Mishra, 2006; Swafford and Bernes, 2000). The daily suckled milk obtained in this study was higher than that Oguike (2008) (82.26g/day) and lower than that reported by Akouedegni (2012); 114.99g/day. This difference could be due to the impact of enhanced environmental and managerial conditions (housing, feeding at higher concentrate level, mineral supplementation, health care among other factors as treatment).

Medicinal plants are the interest subject of research, but their extraction as part of phytochemical or biological investigations presents specific challenges that must be addressed throughout the solvent extraction process. In the present study, the type of solvent used for extraction had no effect on milk production of ewes (Figure 3). The active chemical constituents were soluble in methanol and ethanol. The active ingredients were therefore not a protein or lipid as reported by Sawadogo (1987).

The extracts of *V. paradoxa* showed no lactogenic activity (Table 3). These results obtained confirm the doubt reported by Sawadogo (1987) on the lactogenic activity of some plants cited by the popular tradition. According to the author, of 32 plants supposed lactogenic, only 7 plants have been active. These results obtained may also be due to an insufficient amount of extract administered (Sawadogo, 1987).

The average value of 1.61 kg for birth body weight (Table 3), found in the present study, compares well with those reported by Akouedegni (2012), Amégée (1984), Abassa *et al.* (1992) in Togo and London and Weniger (1995) in Ghana (1.44-1.75 kg). Slightly higher values were found by Gbangboche *et al.* (2006) in Benin and Bosso (2006) in The Gambia (1.84-2.2kg kg). This difference could be due to the parity, body weight and managerial conditions of ewes.

The growth performance was significantly higher in the lamb of the *Spondias* groups (88.58 and 86.80g/day) than *Vitellaria* groups (70.34; 74.29g/day) and Control group (74.51g/day) (Table 3). The positive effect of the treatment based *S. mombin* on growth performance of lamb is due to milk production performance of their mothers. The higher daily gain of the *S. mombin* lambs can be related to their higher milk consumption. Indeed, for young lambs unable to intake solid food, breast milk is the only source of nutrients (Coulibaly, 1988) and their growth performance depends (Abassa, 1992). Increased milk intake is significantly associated with increased body weight (Korman, 2001; Niznikowski *et al.* 2006). The average daily gain obtained in *Spondias* groups (88.58 and 86.80g/day) (Table 3) are in accordance with those reported by Akouedegni (2012); Poivey

(1982) and Amégée (1984) (81.8 – 92g/day). But the results reported by these authors are higher than those obtained in Vitellaria (70.34; 74.29g/day) and Control group (74.51g/day). This difference could be explained by the poor milk production of dams that influence the growth performance of their progeny.

The sex of the lamb had effect on average daily gain (ADG) of lamb (Male = 81.91g/day; Female = 77.35g/day) but this difference was not statistically significant (level 5%) (Table2). These results stemmed from both physiological (Butler-Hogg and Brown, 1986) and endocrinal (Inyangala et al, 1984) differences between the sex male and female. Under the same managerial conditions, a male lamb may be heavier in birth weight than a female lamb Otésile (1993), but effect of sex disappears after 30 days (Vallerand et Branckaert, 1975; Poivey et al., 1982). A significant effect of sex on WAD lambs was however reported by Senou (2009), Gbangboche et al (2006) and Yapi-Gnaoré et al (1997). But such a result is questionable, if the type of birth and parity are to be considered.

MCL tended to decrease in magnitude as lactation progressed in all groups (Table 4). These

results suggest a decreasing dependence of lambs on milk and increasing dependence of lambs upon forage or creep feed with advancing lamb age. It could be admitted that lambs weight gain dynamics was influenced by their mother's milk production, at least until a certain age. However, very few data is known, related to milk conversion toward meat (variation and amplitude) and especially to the value level of the transformation coefficient that should be accepted for WAD sheep and periods. Milk conversion lamb (MCL) obtained in this study (on average 1.18) (Table4) is lower than those reported Boujenane (1996): on average 4.6 for sheep Island France, Merino Precocious, Suffolk, Sardi and Beni Guil Timahdite. This result be partly due to the genetic group (WAD in this study), on the other hand to the low milk suckled by WAD lambs and better processing of this amount of weight gain (WAD ewe poor milker compared to other dairy breeds). Indeed, Owen (1957) found that there is a positive relationship between milk intake and milk conversion; a lamb transforms more milk intake when it receives little.

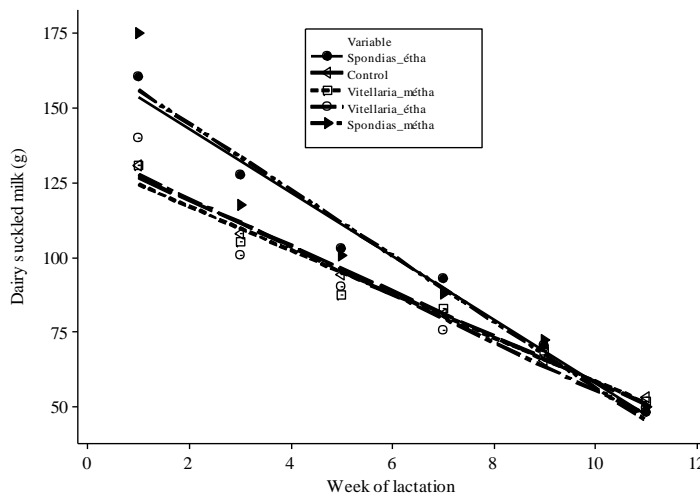


Fig. 1: Regression of daily milk production.

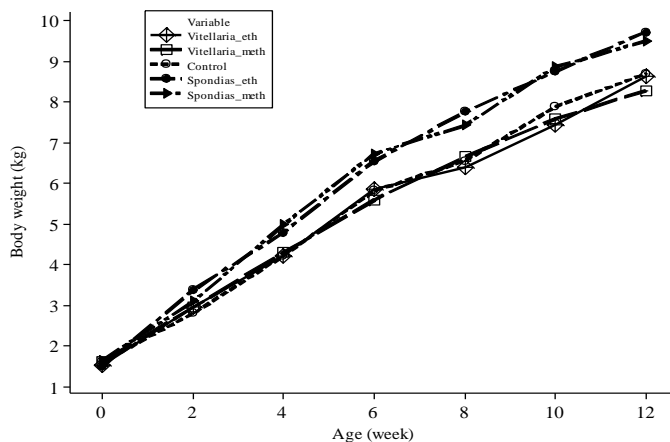


Fig. 2: Body weight of lambs according to age and treatment.

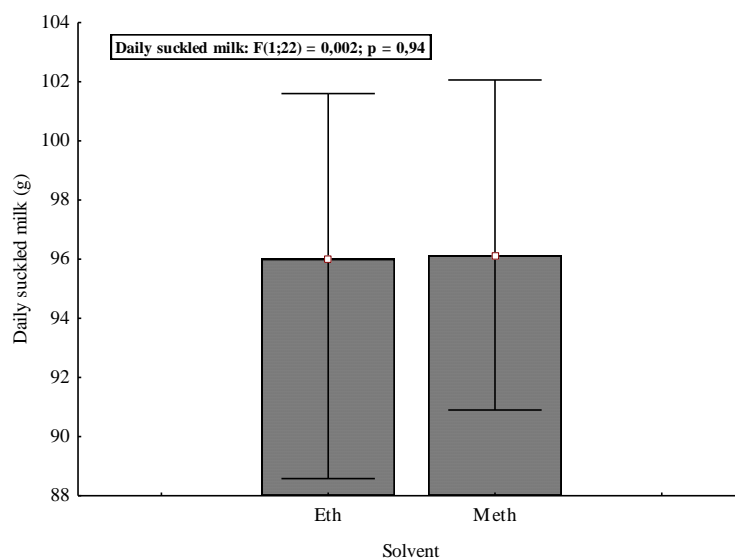


Fig. 3: Effect of type of solvent used for extraction on daily suckled milk.

Table1: The regression equations, coefficients and probabilities.

Treatments	Regression equation	r	p
Spondia_eth	$y = 164.93 - 10.34*x$	-0.97	0.0003
Spondias_meth	$y = 170.56 - 11.34*x$	-0.96	0.0006
Vitellaria_meth	$y = 128.44 - 6.91*x$	-0.98	0.00009
Vitellaria_eth	$y = 136.41 - 8.03*x$	-0.98	0.0001
Control	$y = 133.64 - 7.46*x$	-0.98	0.00005

y= Daily milk suckled (g) x = week

Table 2: Effect of sex of lamb on some production parameters (Mean ± Standard deviation)

Parameters	Sex		Meaning
	M	F	
ADG lambs (g / day)	81.91 ± 8.26	77.35 ± 6.51	ns
Daily suckled milk (g)	94.92 ± 4.64	96.09 ± 6.34	ns
Final body weight of ewe (kg)	16.93 ± 0.58	16.86 ± 0.72	ns
Milk conversion lamb	1.10 ± 0.40	1.34 ± 0.36	ns

ns = no significant,

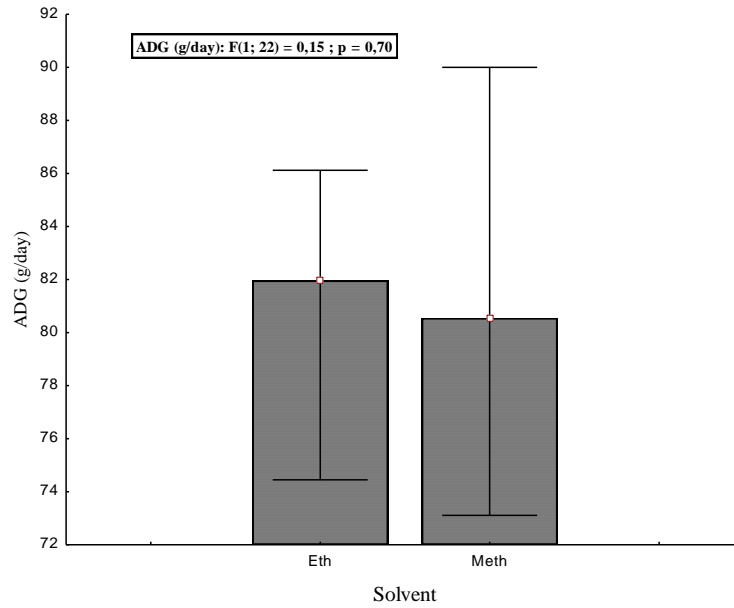


Fig. 4: Effect of type of solvent used for extraction on average daily gain.

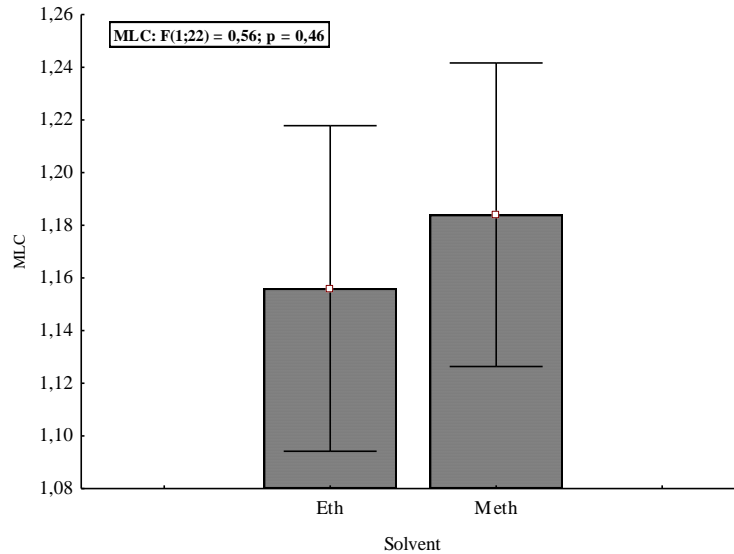


Fig. 5: Effect of type of solvent used for extraction on average daily gain.

Table 3: Body weight, Average Daily body weight Gain (ADG) and milk production (Mean ± Standard deviation)

Milk production(g)	Treatments				
	<i>Spondias_ eth</i>	<i>Spondias_ meth</i>	<i>Vitellaria_ eth</i>	<i>Vitellaria_ meth</i>	<i>Control</i>
Daily suckled milk	101.14 ± 3.48 ^a	100.13 ± 3.17 ^a	90.89 ± 2.99 ^b	92.13 ± 3.42 ^b	92.90 ± 3.77 ^b
Total milk yield	9098.5 ± 341.5 ^a	9009.1 ± 260.7 ^a	8182.7 ± 290. ^b	8279.2 ± 302.3 ^b	8352.4 ± 365.9 ^b
Growth performance of lamb (g)					
Birth	1.56 ± 0.22 ^a	1.65 ± 0.13 ^a	1.62 ± 0.15 ^a	1.61 ± 0.15 ^a	1.62 ± 0.15 ^a
90days	9.62 ± 0.74 ^a	9.51 ± 0.69 ^a	8.67 ± 0.43 ^b	8.70 ± 0.26 ^b	8.72 ± 0.50 ^b
ADG lambs (g / day)	88.58 ± 6.68 ^a	86.80 ± 5.62 ^a	70.34 ± 2.93 ^b	74.29 ± 0.97 ^b	74.51 ± 4.29 ^b
Ewe body weight (kg)					
Initial weight	15.81 ± 0.65 ^a	15.55 ± 0.69 ^a	15.99 ± 0.87 ^a	15.73 ± 0.73 ^a	16.12 ± 0.61 ^a
Final weight	16.91 ± 0.59 ^a	16.65 ± 0.64 ^a	17.15 ± 0.75 ^a	16.74 ± 0.59 ^a	17.03 ± 0.72 ^a

a, b, c = Means with different superscript letters on the same row differ significantly (p <0.05).

Table 4: Milk conversion of lamb (MCL) according treatments (Mean \pm Standard deviation)

	Treatments				
	Spondias_ eth	Spondias_meth	Vitellaria_ eth	Vitellaria_meth	Control
0--15days	1.62 \pm 0.21 ^a	1.67 \pm 0.19 ^a	1.80 \pm 0.22 ^a	1.75 \pm 0.22 ^a	1.8 \pm 0.15 ^a
15--30days	1.06 \pm 0.12 ^a	1.07 \pm 0.14 ^a	1.18 \pm 0.09 ^a	1.12 \pm 0.12 ^a	1.17 \pm 0.11 ^a
30--45days	1.02 \pm 0.11 ^b	1.02 \pm 0.07 ^b	1.05 \pm 0.09 ^a	1.04 \pm 0.12 ^a	1.07 \pm 0.20 ^a
45--60days	1.18 \pm 0.11 ^a	1.16 \pm 0.07 ^a	1.09 \pm 0.08 ^a	1.18 \pm 0.17 ^a	1.21 \pm 0.14 ^a
60--75days	0.90 \pm 0.19 ^a	0.93 \pm 0.09 ^a	1.01 \pm 0.12 ^a	0.95 \pm 0.14 ^a	0.95 \pm 0.15 ^a
75--90days	0.95 \pm 0.10 ^a	0.95 \pm 0.20 ^a	0.91 \pm 0.11 ^a	1.15 \pm 0.21 ^a	1.11 \pm 0.18 ^a
Mean	1.12 \pm 0.33 ^a	1.14 \pm 0.30 ^a	1.19 \pm 0.32 ^a	1.23 \pm 0.36 ^a	1.24 \pm 0.38 ^a

a, b, c = Means with different superscript letters on the same row differ significantly ($p < 0.05$).

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