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SHORT NOTE

Supplementation with coconut oil for piglets until weaning

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Additional keywords
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SUMMARY

This study evaluated the performance and mortality of piglets from birth to weaning undergoing a diet supplemented with coconut oil, as well as performed the environmental characterization of facilities. The experiment was carried out using pig maternity facilities. The experimental design consisted of a completely randomized block design with two treatments, eight blocks and twelve piglets per experimental unit. The supplemented piglets received 12 ml of coconut oil. Piglets creeps provided stable conditions in the hottest hours of the day for the stalls. The relative humidity remained below the optimal levels for pigs at the hottest times of the day; BGTHI was appropriate for the recommendation of thermal comfort. No effect (p>0.05) of the supplementation with coconut oil on the average daily gain weight of (g/day) of piglets until weaning was reported and the values obtained were 227 g/day and 228 g/day, without the use and the use of coconut oil, respectively. The mortality rate of supplemented piglets 1.66 % and those who did not receive supplementation 5%, showed the importance of coconut oil when taking the production of piglets per sow into consideration.

Suplementação com óleo de coco para leitões até o desmame

Palavras-chave adicionais
Suínos.
Lipídeos.
Ganho de peso.
Mortalidade.

RESUMO

Objetivou-se avaliar o desempenho e mortalidade de leitões do nascimento à desmama submetidos a dieta suplementada com óleo de coco, bem como realizar a caracterização ambiental das instalações. O experimento foi realizado utilizando instalações suinícolas de maternidade. O delineamento experimental foi em blocos inteiramente casualizados, com 2 tratamentos, oito blocos e doze leitões por unidade experimental. Os leitões que foram suplementados receberam 12 ml de óleo de coco. Os escamoteadores proporcionaram condições estáveis nas horas mais quentes do dia, em relação às baias. A umidade relativa do ar permaneceu abaixo dos patamares ideais para os suínos nos horários mais quentes do dia; o ITGU esteve apropriado na recomendação do conforto térmico. Foi verificado que não houve efeito (p>0,05) do uso de suplementação com óleo de coco sobre o ganho de peso médio diário (g/dia) dos leitões até o desmame, os valores alcançados foram 227 g/dia e 228 g/dia, sem o uso e com o uso de óleo de coco respetivamente. A taxa de mortalidade dos leitões suplementados foi de 1,66% e aqueles que não receberam a suplementação foi de 5%, mostrando a importância do óleo de coco quando se leva em consideração a produção de leitões por matriz.

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INTRODUCTION

In the pre-weaning period is occurring the greatest losses, deaths in intensive pig production systems (IPPS). Worldwide, 4-10 % of pigs born die in childbirth and another 20 to 30% may die before weaning. According to Abrahão *et al* (2004) according to various publications, from different countries, pre-weaning mortality can vary between 11.5 and 18.6%. Thus, improvement of productivity pig guided by the index of weaned piglets/sow/year becomes an important parameter productivity.

According to Gomes *et al*. (2010) and Camargo *et al*. (2013) litter size has a direct impact on the cost of pro-

duction activity and other factors that also influence this parameter as stillbirth, mortality until weaning, weaning the range coverage, non- productive days and the interval calving . In addition to factors related to genetics, management of sows during lactation, the distribution of parities, stress, diseases and fertility of boar (Lawlor and Lynch, 2007).

Bruessow and Waehner (2008) in Germany, studying the potential fertility of sows Landrace, Large White and Pietrain, found 10.4, 11.3 and 10.2 for the piglets total variable born, and potential fecundity of 15 piglets/born, 2.4 births/female/year and 32.5 piglets produced/female/ year. Lawlor and Lynch (2007) pointed average of 11.2 piglets born alive/irth in Ireland, 12.5 in France and 12.7 in Denmark.

Amid the losses incurred in the maternity sector, neonatal mortality is the most significant, because it is between 39-60 % of deaths occurring in the first three days of life after birth (Van Der Lande *et al*., 2001; Furtado *et al*., 2012) and the first 24 hours after birth are the most difficult time .

The fundamental cause of neonatal mortality related to low intake of colostrum and low birth weight (Ferrari *et al*., 2014). The low body weight piglets are less vigorous and need more time to make the first feeding (Spicer *et al*., 1986). In addition to light piglets at birth have lower energy reserve and a larger body surface area compared to its weight (Herpin *et al*., 2002), being further disposed to undernourishment and hypothermia. Thus, small piglets have fewer chances of survival requiring greater attention during the first three days of life. One strategy is to assist the energy supplementation with basic fatty acids, mainly the medium chain length (C6 - C12) during the first days of life (Benevenga *et al*., 1989; Chiang *et al*., 1990).

Lipids play important physiological functions in the animal body. Is a form of storage and energy supply, protect the body from cold, are structural components of the nervous tissue. Regulate the metabolism and are structural components of membranes and provitamins (Zardo and Lima, 1999). According to Mahan (1991) and Flemming(2010) a higher response coconut oil is attributed to its lower chain length and a high absorption rate via the bloodstream, compared to the fatty other vegetable lipids and animal acids, which are more rapidly absorbed via lymphatic system.

For Sobestiansky *et al*. (1987) piglets heating with a heat source is necessary, precisely because the lower environmental temperature causes the piglets stay longer in creep, reducing the ingestion of milk. This promotes the mobilization of glycogen reserves in the body, which depending on the intensity caused the death of piglets by hypoglycemia. According to Quesnel (2011), colostrum provides newborn piglets, the essential energy for their thermoregulation. However, at least 1/3 of the sows don't produce colostrum in amounts sufficient to meet the needs of the litter. According to Ferrari (2013), consumption of insufficient amount of colostrum and / or alternative energy sources leads to starvation predisposing piglets hypothermia, crushing and the occurrence of diarrhea. Thus, the energy supplementation of piglets via alternative sources is of great importance for maintaining the body temperature of the pigs. The objective of the present study to evaluate performance, mortality and body temperature of the birth of piglets at weaning supplemented with coconut oil.

MATERIAL AND METHODS

The experiment performed in *Barro Branco* farm in Canaã county, in the Minas Gerais state, having as geographical coordinates: Latitude - 20º 41' 09" S, longitude 42º 37' 11" W and altitude of 718 m The local climate is type *Cwa* characterized by tropical climate, with rains in summer and dry in winter, according to Köppen. The development of the research in the farrowing house, in the period between birth and weaning of piglets, with an average duration of 21 days, between three and 25 August 2014. The maternity ward characterized typologically by 23.3 m in length, 4.7 m in width and ceiling height of 3.5 m, with side aisles of 1.2 m longitudinal 1.25 m wide. The room contained 08 pens with 4.16 m^2 of floor area (2.6 x 1.6), the creep area of 1.3 m^2 and had short wall 0.61 m high.

The experimental design completely randomized block design with two treatments (with coconut oil and without supplementation), five blocks (sows) and twelve piglets per experimental unit. The piglets supplemented received 6 mL coconut oil orally after 6 hours of birth, to perform the feeding colostrum and 6 ml of coconut oil after 18 hours of birth, a total of 12 ml of coconut oil given to piglets.

Selected sows of fourth order, according to the availability of animals, with delivery forecast coincident with the experimental period. Ten sows 120 and both pigs belonging to the Large White breed were used. Each stalls initially presented 15 piglets. At birth, the piglets dried with *wiping dust* (aluminum sodium silicate) and placed with the female for suckling colostrum. As born piglets conducted management to ensure that everyone would adequately suckling colostrum and after the cord broken.

Piglets weighed at birth, weekly and weaning. The average daily gain (ADG) obtained by dividing the total weight gain (TWG) by the number of days (ND) in which the animals kept in maternity, according to the equation: ADG = TWG/ND. The daily number of deaths recorded during the period in which the animals remained at the hospital. During the experimental period, the supply of water *ad libitum* for sows and piglets. Sows received corn and soybean based feed according to the dietary management of the farm, provided in the schedules of 6h, 12 h and 18 h. The creep shelters had two incandescent lamps responsible for heating them.

In the production of pigs, regardless of adopted breeding system, environmental analysis is necessary from the thermal comfort and animal welfare, as these factors directly affect the maintenance conditions of thermal balance and animal productivity. The pig has difficulty to dissipate heat in high temperature and humidity, due greatly to the fact that these animals are unskillful in perspire (Barnett *et al*., 2001), and evolu-

tionarily adapted to temperate climates (Bloemhof *et al*., 2008). In weather conditions and productive reality in Brazil, the analysis of pig production is lacking in terms of bioclimatic information regarding the thermal environment and responses in the production of piglets supplemented with energy supplementation.

Throughout the experiment, the environmental variables monitored in creep, the farrowing house and the external environment and registered by means of sensors connected to an automatic platform data collection, the following variables: dry bulb temperature (Td) wet bulb temperature (Tu), black globe temperature (Tg) and wind speed (Ws). In addition, parameters measured for analyzing air quality in the installation environment of these being: ammonia (NH_3), carbon dioxide (CO_2) and carbon monoxide (CO). To determine the thermal efficiency in each treatment, with data collected from the study sites determined the black globe temperature and humidity index (BGTHI) as equation proposed by Buffington *et al*. (1981).

The variables were analyzed using the Statistical Analysis System (SAS, 1992). The results were submitted to analysis of variance and regression at 5 % probability by Tukey test.

RESULTS AND DISCUSSION

Regarding animals supplemented and unsupplemented with coconut oil, it was observed that there was no difference in average weight gain (kg) at birth intervals until weaning **(table I)**.

No significant effect (p>0.05) for the energy supplementation using two doses of 6ml/kg (6 and 18 hr of life) of coconut oil on the daily gain (g/day) of piglets 21 days **(table I)**, or until weaning. So that the values 227 g/day and 228 g/day, without the use of coconut oil, respectively. However, sows, which piglets supplemented with coconut oil, weaned on average 15 piglets/matrix with average live weight of 4.80 kg. While the headquarters, where the piglets don't receive supplementation, the average number of piglets weaned was 12 piglets/matrix, with average live weight of 4.77 kg. Precisely because the mortality rate 1.66% for the piglets that supplemented with coconut oil and piglets did not receive supplementation 5%, reflecting the beneficial effects of supplementation when guided by productivity matrix. Benevenga *et al*. (1989) observed that when given a single dose of 12 ml of medium chain triglycerides (MCT), no reduction in piglet weight gain, however with a single dose of 24 ml milk intake impaired. Soon, Lee and Chiang (1994) concluded that to provide two doses of 6 ml / kg (14 and 26h of life) TCM growth of piglets considered less weight (≤ 1000g) from birth to weaning did not affected. Cypriano (2008) evaluating the performance of piglets supplemented with coconut oil (6 ml oral) compared to the control group, found no effect of treatments on weight gain to 0- 7, 0-14 and 0-21 days of life. Therefore, the present study corroborates this sense; precisely why the differentiated management would intended to reduce mortality especially in the first three days of life.

Table I. Average weight gain (kg) at birth intervals for 7 days, 0-14 and 0-21 days of life (Ganho médio de peso (kg) do nascimento aos 7 dias, aos14 e aos 21 dias de vida).

Treatments	Interval in days		
	0-7	0-14	0-21
With coconut oil	0.979[a]	2.698[a]	4.805[a]
Without coconut oil	0.909[a]	2.823[a]	4.768[a]
CV%	34.13	25.32	21.93

* Means followed by the same letter in the column do not differ statistically from each other at 5% Tukey test.

Perhaps these results are associated with the fact that in the early hours of life, the infant has only glucose from the liver glycogen as the main energy source, which is just enough to ensure their needs only a few hours (Varley, 1995). Cypriano (2008) found that mortality rates of piglets supplemented were 7.85 % and without supplementation of 8.5%, respectively. According Wolter *et al*. (2002), animals are born heavier arrive heavier at weaning as they present greater daily weight gain relative to light born. The advantage of the exogenous supply with coconut oil would save energy reserves after birth (Benevenga *et al*., 1989). Greater attention has been directed to low birth weight piglets (<900g) at birth, given the level of maturity of their metabolic development in relation to average piglets (1200g to 1500g), because small piglets have low probability of survival (Pettigrew, 1981).

Temperature data, humidity and BGTHI were compared weekly as the study period from birth to weaning of piglets, corresponding to 21 days (3 weeks). It observed that the first, second and third week **(figure 1.A)** the stalls showed more unstable temperatures when compared to temperatures measured in creeps and the external environment.

The first two weeks, the temperature considered did not met the of the the piglets and its mean was around 28 ° C, from the third week the temperature conditions were maintained with the same average (around 28 ºC) but slightly above the range comfort advocated for the third week of life of these animals.

The use of creeps proved of great importance for all periods, because the temperatures of the stalls and the one from the external environment was low, which highlights the need for heating source use during the period. Already the headquarters remained much of the time within the comfort range for the category, except for the known peak hours, where temperatures of the stalls amounted to levels that characterize thermal stress to the animals. In the first week, this peak reached 36 ºC and within two weeks suffered 6 ºC fall, getting around 30 ºC.

In terms of relative humidity (%RH) during the three week study period **(figure 1.B)** it found that it stable in creeps when compared with the results of the bays and external environment. For BGHI variable in the three-week study, the values very close. The bays and shelters creeps had significant influence **(figure 1.C)**. However, the results obtained in creeps more

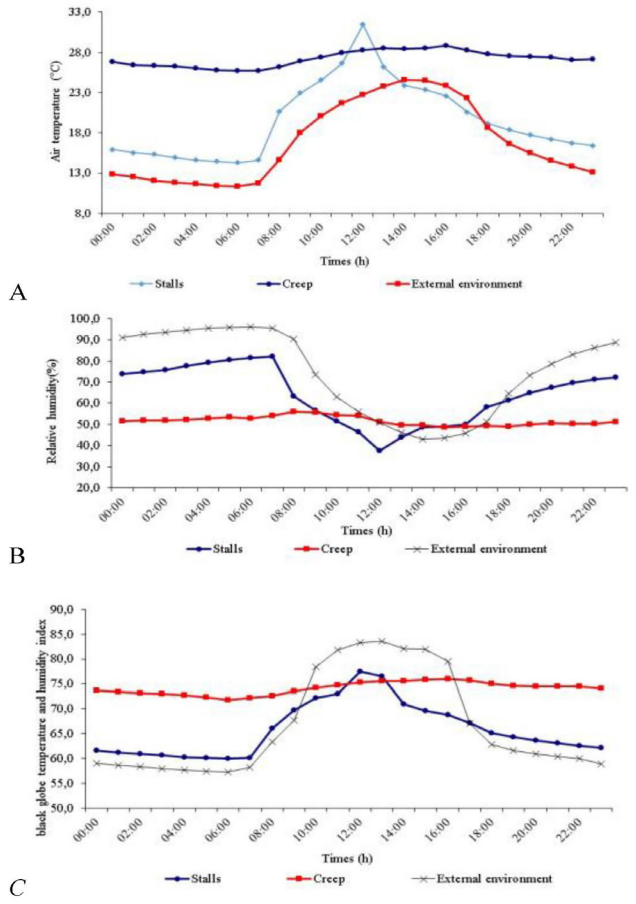

Figure 1.A. Air temperature (°C); B. Relative humidity (RH %) and C. Black globe temperature and humidity index in the external environment, stalls and creep (A. Temperatura do ar (°C); B. Umidade relativa do ar (UR %) e C. Índice de temperatura de globo negro e umidade no ambiente externo, baias e escamoteadores).

stable when compared with those obtained in the bays and in the external environment, which provided possibly greater thermal comfort for piglets.

Observed that there is a linear increase in BGTHI for creeps with increasing ambient temperature when considered the peak time. BGTHI values calculated for the piglets during the experimental period around 70 and 75. This variation of the BGTHI in the creeps shelters showed values close to ideal, but still below the comfort range considered, which is between 82 and 84 (Pandorfi *et al*., 2005) .

To work around this situation can raise handheld devices for the animal to feel more comfortable under stress by cold, the use of materials, which are thermal insulators, for example, the use of paper as bedding can help piglets stay heated. During the experimental period we did not record values of ammonia (NH_3) and carbon monoxide (CO), ie, their values were insignificant or close to zero. For CO_2 levels, these kept below harmful limits, and the average submitted for the analysis day period was 953 ppm.

Pigs, for their physiological characteristics, have difficulties in adapting to environmental thermal fluctuations. The temperature range for your comfort varies with age. To zero piglets to two weeks of life is the comfort range is between 30 and 32ºC (Mendes, 2005), and 25 °C at weaning (Woloszin, 2005) is the ideal temperature range for the array in milk is between 12 and 22 ºC (Bloemhof *et al*., 2008). This study found the temperature peaks in the stalls, every week if they gave us times of 11 to 14 hours, those who known to high environmental temperatures. Agreeing the results for the same factor in the study of Corassa *et al*. (2014) which found higher temperature records at 12 and 15 hours, while the lowest temperatures recorded at 3:06 h at all times, in the present study we observed them between 3:07 hours.

Ferreira (2005) considered ideal for piglets values of 50 to 70 % relative humidity. Values below 40 % and above 80 % can be considered critical, since they make the exchange more difficult to heat animals. For creeps, it was found that the curve for humidity showed a peak at 12 hours which remained about RH 50%, or within the limits of comfort RH for piglets. This result differs from Furtado *et al*. (2012) found that for RH%, in the dry season values ranged from 35.77 % to 69.09 %, so that the % RH is not within the limits termoneutrality to piglets.

The variation of the relative humidity inside the creeps showed differences in the stalls. So possibly pose to assess the heating promoted by incandescent bulbs within the creeps, may have influenced the reduction of the relative humidity, hence the creep environment. However not brought problems as RH% showed within the range comfort limit for piglets. In all weeks, the RH values low in the bays during a time interval in the day, except between the early afternoon (18 hours) and early morning until 9 hours. From that time it observed decrease in RH, which according to Castro *et al*. (2013) can be attributed to management opening the side curtains, which allowed ventilation influence the dissipation of water vapor within the facility. Moreover, in the known zones of higher temperatures, lower levels of RH% for the stalls found.

During the night and early morning, the ones who met the conditions of comfort of the animals, but it observed that in those three weeks the values exceeded this limit. In the first week UR amounted to 75 % in second week the rate close to 83 % and in the third week reached 85% humidity in the morning (from the hours of 5:08 hours). The values considered comfort for pigs in this category is between 60 and 70%. (NÄÄS 1989). This shows that these animals suffered from the high humidity during this period.

The loss of heat to the environment in the evaporative form becomes impaired provided high values of temperature and humidity (Corassa *et al*., 2014) which can attenuate the ability of mothers to dissipate heat because the air saturated compromises loss of latent heat through the respiratory system, leading to a stressful environment over the animal (Castro *et al*., 2013). Regarding sows, Turco *et al*. (1998) and Campos *et al*. (2008) determine the critical value of 72 BGTHI infant sows. However, it can observed that these remained for much of the day in a comfortable situation, except

only in times of 11 to 14 hours, and this behavior of the variable can be seen in the three -week study.

In the first, second and third weeks BGTHI peak values respectively close to 80, 73 and 75, respectively, confirming that the animals kept in pens discomfort in these times of day considered elevated temperatures. Because these are two distinct categories (sows and piglets), occupying the same area, there is a balance of need in environmental comfort care for these animals. What can done so that both remain in comfort is to perform a different management, throughout the day, and the times of higher temperatures, arrays can breastfeed and then immediately stay in a thermoneutral environment (24 °C) and piglets directed immediately to creeps order to keep them warm.

With respect to the concentration of ammonia (NH_3), the values are inferior to the concentrations by Benedi (1986), 10 ppm, and the maximum concentration may reach 20 ppm as CIGR (1994). Possibly the small volume of manure generated by the animals and the sanitary management employee, explain values below the maximum allowable concentration, within the maternity facilities were the standards (CIGR, 1994; NR-15, 1978) for animals and workers.

This result may related to the heating system that electric and not wood furnace where heating is arising from the burning of combustible materials. The environmental conditions presented adequate for the comfort of the animals. There no effect for the use of coconut oil supplementation on average daily weight gain (g/day) until weaning pigs, however, the mortality rate of the piglets supplemented by 1.66% for those who did not receive supplementation 5%, showing the importance of coconut oil when taking into consideration the production of piglets per sow.

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ETHICS COMMISSION

Process nº23149.000293/2016-11, Ethics Committee on the use of animals of the Federal do Espírito Santo - CEUA/IFES.

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