

ANIMAL BEHAVIOUR IN ACTION

2021



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1-2 DECEMBER 2021

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Schedule

Wednesday 1st of December – Behaviour in Action

AEDT	WAT	Moderators: Dr Durosaro Samuel and Oyeniran Victor	
17:00-17:10	8:00-8:10	Introduction	
17:10-18:00	8:10-9:10	Plenary: Prof. D.M. Broom	
18:10-18:20	9:10-9:20	Tea break	
Presentations			
18:20-18:35	9:20-9:35	Lisa McLerie	<i>Environmental sensory conditions can reduce pre-slaughter stress indicators</i>
18:35-18:50	9:35-9:50	Dr Moud Bonato	<i>Sleeping pattern of African elephants when lying down at night in a semi-captive population</i>
18:50-19:05	9:50-10:05	Bonnie Mayes	<i>Sheep housed at high stocking densities show behavioural adaptation over time</i>
19:05-19:10	10:05-10:10	Short break	
Poster session			
19:10-19:25	10:10-10:25	Ojelade Oluwaseun	<i>Effect of varying photoperiod regime on the growth rate of catfish</i>
		Popoola, Moshood	<i>Relationships between agonistic behaviour and physical traits in Nigerian indigenous rams</i>
		Oluyemi, Ayoola	<i>Effect of environmental enrichment on performance and behavioural response in pigs</i>

Thursday 2nd of December - Behaviour in Action

AEDT	WAT	Moderators: Dr Danila Marini and Dr Jessica Monk	
17:00-17:10	8:00-8:10	Introduction	
17:10-18:00	8:10-9:10	Plenary: Dr Sally Sherwen, Zoos Victoria People, Animal Welfare and Conservation; aligning key priorities for zoos and the role of research	
18:10-18:20	9:10-9:20	Tea break	
Presentations			
18:20-18:35	9:20-9:35	Oyeniran Victor	<i>Pre-natal responses of FUNAAB Alpha broilers to playback calls</i>
18:35-18:50	9:35-9:50	Oyekunle Oluwatowo	<i>Effect of environmental enrichments on the behaviour of Nigerian indigenous chickens</i>
18:50-19:05	9:50-10:05	Manning Primrose	<i>Effect of COVID19 restrictions on anxiety-related behaviour in African elephants</i>
19:05-19:10	10:05-10:10	Short break	
Poster session			
19:10-19:25	10:10-10:25	Oso Oluwadamilola	<i>Post hatch behavioural and welfare responses of slow growing broilers</i>
		Ehigbor Tunmise	<i>How do goats react during reunion after a short term separation</i>
		Dr Durosaro Samuel	<i>Genotypic differences in fear response of meat type chickens</i>

Plenary Speakers



Prof. Donald M. Broom

Donald Broom has M.A., Ph.D. and Sc.D. degrees from the University of Cambridge, plus several honorary degrees and he worked as Lecturer and later Reader at the University of Reading, Department of Zoology 1967-1986. In 1986 Donald Broom was appointed the first Professor of Animal Welfare in the world in the Department of Veterinary Medicine, University of Cambridge. He set up a research group, the Centre for Animal Welfare and Anthrozoology CAWA. In his Centre for Animal Welfare and Anthrozoology, he has developed concepts and methods of scientific assessment of animal welfare and studied: cognitive abilities of animals, the welfare of farmed and other animals in relation to housing and transport, behaviour problems of pets, sustainable livestock production, attitudes to animals and ethics of animal usage. He has published over 360 refereed papers, lectured on animal welfare in 45 countries and served on UK (FAWC and APC) and Council of Europe committees. He has been Chairman or Vice Chairman of EU Scientific Committees on Animal Welfare 1990 – 2009 and a member of the EFSA Panel on Animal Health and Welfare until June 2012. He chaired the O.I.E. group on Welfare of Animals during Land Transport. Amongst his twelve books are Stress and Animal Welfare (Broom and Johnson 1993, Springer), Coping with Challenge: Welfare in Animals including Humans (Broom ed. 2001, Berlin: Dahlem University Press, The Evolution of Morality and Religion (2003, Cambridge University Press), Sentience and Animal Welfare, 2014 CABI, Domestic Animal Behaviour and Welfare, 5th edition, (Broom and Fraser 2015, CABI) and Tourism and Animal Welfare (Carr and Broom 2018, CABI).



Dr. Sally Sherwen

Dr Sally Sherwen has a Bachelor of Science, Master of Science (Hons), PhD from the University of Melbourne. Sally is the Director of Wildlife Conservation and Science at Zoos Victoria (the Conservation Organisation charged with the operation of Melbourne Zoo, Werribee Open Range Zoo and Healesville Sanctuary in Australia). She manages the team that has a strategic focus across the zoos conservation and education programs, science and research programs, life sciences development (animal welfare, species planning, animal husbandry optimisation) and environmental sustainability. Sally has a PhD in Animal Welfare Science and in previous roles has established an evidence-based research program in animal behaviour and welfare science, developed and implemented an institutional welfare assessment tool to advance welfare standards and designed and ran collaborative training courses with several NGOs for industry professionals and community groups. Sally also sits on several advisory committees to bring expertise in animal welfare and applied research and also acts on several editorial boards for scientific journals

Presentations

Presenter	Title
Lisa McLerie	<i>Environmental sensory conditions can reduce pre-slaughter stress indicators</i>
Dr Moud Bonato	<i>Sleeping pattern of African elephants when lying down at night in a semi-captive population</i>
Bonnie Mayes	<i>Sheep housed at high stocking densities show behavioural adaptation over time</i>
Oyeniran Victor	<i>Pre-natal responses of FUNAAB Alpha broilers to playback calls</i>
Oyekunle Oluwatowo	<i>Effect of environmental enrichments on the behaviour of Nigerian indigenous chickens</i>
Manning Primrose	<i>Effect of COVID19 restrictions on anxiety-related behaviour in African elephants</i>

Environmental Sensory Modifications Can Reduce Pre-Slaughter Stress Indicators and Improve Behaviour in Grain Fed Cattle

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Cattle can be exposed to pre-slaughter stressors that have negative impacts on cattle behaviour and welfare. Environmental sensory modifications (sight, sound, smell) can reduce stress, but they have not been investigated in a commercial beef processing setting. This study investigated if environmental sensory modifications could reduce pre-slaughter cattle stress and improve cattle behaviour at a commercial beef processing facility. The study was approved by the Murdoch University Animal Ethics Committee (R3302/20). The following environmental conditions were tested individually; (1) reduction of intermittent plant noise (removal of safety siren), (2) masking abattoir odours with hay odours provided in the cattle race way, (3) lights added to illuminate cattle race way, and (4) an acoustic sound wall enclosing the lead-up chute to the site of euthanasia reducing the noise levels from 100 to 72 dB hertz. Cattle of mixed sex (female=320, male=1178), age (0-8 teeth) and breed that had been on a 100-day grain feeding program prior to slaughter were selected. The breeds consisted of Angus, Murray Grey, Simmental, Limousin, Red Angus, Droughtmaster, and Ultra Black. Cattle were not selected for breed type, age or sex in this study and hence was not included in the analysis. The environmental modifications were tested singularly. Each experimental group consisted of 40 cattle and were randomly divided into 2 groups of 20 cattle (control and treatment). Three replicates of each treatment were repeated giving a total sample size of 60 per treatment. Blood samples were collected immediately post-slaughter and were analysed for glucose, lactate, magnesium, creatine kinase and aspartate aminotransferase. All carcasses were graded by qualified Meat Standards Australia (MSA) graders after overnight refrigeration and measurements included ultimate pH (pHu), with increased levels indicating pre-slaughter stress. Cattle behaviour was assessed by Qualitative Behavioural Assessment (QBA), in which observers scored the demeanour of the cattle using a fixed list of terms after viewing short video clips as they walked through the raceway leading to the site of euthanasia. The blood parameters and pHu as carcass variables were analysed using General Linear Models (GLM) to determine the impact of treatment, which was performed using the Statistical Analysis System SAS. The QBA data was generated by the method of Principle Components Analysis (PCA), performed using the statistical package Genstat. Each of the assessed animals received a score on the two main PCA consensus dimensions that were generated, and these scores were analysed with a mixed-model ANOVA to determine if there was an effect of treatment (fixed factor) on the transformed PCA dimension scores given to the animals. The QBA observers had a significant consensus in their scores when observing cattle demeanour ($P < 0.01$). The cattle groups exposed to the hay-odour and reduction of intermittent plant noise both had higher QBA scores than the controls, with the observers scoring them as less “frustrated” and less “agitated” ($P < 0.01$). The ultimate pHu decreased ($P < 0.05$) for both the hay-odour group and reduction of intermittent plant noise group compared to the controls. In the acoustic wall group, there was a significant decrease in plasma lactate ($P < 0.05$), but no difference in QBA scores compared to the control group. There was a negative association between pHu and the QBA scores for the cattle exposed to the hay treatment ($P < 0.05$) indicating that the less *agitated* cattle had lower pHu. This study suggests that environmental sensory

modifications for pre-slaughter cattle, such as odour-masking and noise reduction in the raceway immediately leading up to the point of slaughter at a commercial processing facility, can reduce indicators of pre-slaughter stress such as lactate, pHu of the carcass and behaviour. These improvements would not only benefit the welfare of the cattle, but also meat quality for the consumer and the economic returns and 'social license' for the processor/producer.

Sleeping pattern of African elephants when lying down at night in a semi-captive population

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Sleep is an essential welfare aspect of African elephant (*Loxodonta africana*) maintained in captivity. Yet, despite the recent improvements in elephant habitats and husbandry, night-time behaviours are still not well documented. This study investigated sleep behaviour when lying down in a herd of 9 African elephant (three juveniles, three young adults and three mature adults) maintained in semi-captivity in South Africa. A total of 111 nights were recorded over a 33 months period (2015 to 2018). Closed circuit television cameras were used to record the elephants' behaviour from 17:00 to 07:00. Four elephants were individually penned in a boma at night (two bulls and one cow in 2015/2016; two bulls and two cows in 2017/2018) while the rest of the herd could move freely between an indoor and an outdoor camp. Time laying down, time up, location, sleeping side, head direction, quality of the saw dust and number of elephants present in the boma were recorded. Data were analyzed using linear mixed model and Chi-square test procedures of R (version 3.5.2). On average, the elephants slept lying down for (mean \pm SEM) 65.64 ± 0.79 min, ranging from 1 to 267min. Interestingly, no difference in sleep duration when lying down was observed between gender, age category, sleeping side, head direction, whether they were penned or not and quality of the saw dust ($P > 0.05$). However, elephants slept longer lying down as the number of elephants present in the boma increased ($F_{7,511} = 3.55$, $P < 0.001$) with a maximum duration attained when all elephants were inside the boma. Furthermore, while they did not seem to have a favourite side to sleep on ($P > 0.05$), they did prefer a specific location in the boma ($\chi^2 = 443.99$, $df = 32$, $P < 0.001$) and orientate their head in a South-West or North-East direction when lying down ($\chi^2 = 125.83$, $df = 36$, $P < 0.001$), both of which being influenced by age category (location: $\chi^2 = 173.89$, $df = 16$, $P < 0.001$; head direction: $\chi^2 = 46.56$, $df = 18$, $P < 0.001$). Specifically, mature elephants appeared to prefer places further away from the main entrance of the boma, as compared to younger elephants. These results clearly highlight the importance to cater for individual and age-related needs of elephants maintained in captive conditions to allow appropriate levels of quality sleep, especially in tourism orientated parks. In addition, further studies are required to investigate the effect of environmental conditions, especially ambient air temperature, wind speed and relative humidity on sleep behaviour position (i.e standing vs. lying down) and patterns. The authors confirm that the work described in this abstract conforms with the ISAE Ethical guidelines.

Sheep housed at high stocking densities show behavioural adaptation over time.

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Industry stakeholders recognise stocking density as one of the most important determinants of animal welfare during the export of live sheep. Increases in agonistic or aggressive interactions, and instances where one sheep is displaced or forced to move by another, are considered to indicate negative well-being. To ensure that high animal welfare standards related to space allowances are achieved within industry, an understanding of how these behaviours are expressed at a range of relevant stocking densities is critical. The aim of this study was to investigate how the occurrence of agonistic interactions and displacement events among sheep were affected by five current or proposed stocking densities; $m^2/head = 0.32, 0.38, 0.44, 0.50, 0.56$. The experiment was approved by the CSIRO Chiswick Animal Ethics Committee (approval ARA 20/05). Two-tooth Merino wethers ($n = 720$) were housed in pens of varied sizes in groups of 18, with 8 pen replicates per treatment, for 18 days. Surveillance cameras were positioned above each pen and continuous footage was recorded for the duration of the experimental period. Continuous behavioural observations were conducted for 3 focal animals in each pen for two 5-minute periods: a high activity period (1025-1030 h), and a low activity period (1225-1230 h), on days 3, 5, 11 and 17, totalling 80 animal-hours of footage. Counts of agonistic and displacement interactions were scored using The Observer XT© (Noldus Ltd.) and analysed in Stata (StataCorp, Version 16). A negative binomial regression was used, with stocking density and day as main effects on the counts of agonistic and displacement events scored for the 3 focal sheep in each pen, for each observation time separately, and pen was included as a random effect. Agonistic and displacement behaviours were rare in all stocking densities on all days at both observation times. There was evidence of an interaction between stocking density and day for agonistic interactions ($z = 1.85, P = 0.06$) and displacement events ($z = 2.30, P = 0.02$) during active times (1025 h), whereby the mean counts of these behaviours were low across all days for low stocking densities but were higher at the start and decreased over the days for high stocking densities. During active times, on day 3, there was an effect of stocking density such that the mean counts of agonistic interactions decreased by a factor of 0.48 for every addition $0.12m^2/head$ provided ($z = -2.2, P = 0.026$) and on day 5, counts decreased by a factor of 0.56 ($z = -2.14, P = 0.032$). There was no significant effect of stocking density on mean counts of agonistic interactions or displacement events during active times on day 11 or day 17 ($P > 0.05$). Similar results were found for the impact of stocking density on displacement events at 1025 h, with decreases in stocking density reducing displacement events on day 3 ($z = -2.53, P = 0.011$) and 5 ($z = -2.37, P = 0.018$) but having no effect on days 11 or 17 ($P > 0.05$). During the low activity period (1225 h), there was no significant effect of stocking density for any day of the experiment for agonistic ($z = 1.72, P = 0.085$) or displacement ($z = 1.03, P = 0.304$) events. Of note, counts of agonistic and displacement interactions during the inactive period were low. These results suggest that when sheep are housed in higher stocking densities under similar experimental conditions, they may take some time to adapt to their environment, compared to those at lower densities. This should be considered alongside other welfare assessments to clarify the implications of these stocking densities for live export and other intensive housing scenarios.

Pre-natal responses of FUNAAB Alpha broilers to playback calls

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Exposure to playback call during embryonic development may be important in influencing the post-natal behaviour, welfare, performance, productivity and survival of chicks. This work conforms to the Animal Care and Use Committee of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta Nigeria. For this study a total of 234 fertile FUNAAB Alpha eggs were randomly subjected to one of three playback calls; feed call (FCP), alarm call (ACP) and no call play (NCP) with no sounds. The eggs were divided into three replicates (26 eggs per replicate). The playback started on Day 14 of incubation and continued until Day 21 when the chicks hatched. The calls were played continuously for nine hours/ day (09:00-18:00h). The feed and alarm call were downloaded from YouTube through a video downloader and then converted to an audio format (<https://drive.google.com/drive/folders/1pMaW0SWp6U6gCDRc3hCQPw9nCyShrM-C?usp=sharing>). Both calls were played to the developing embryo at an intensity of 70dB. At Day 4 post hatch, 15 FUNAAB Alpha broiler chicks per treatment were subjected to tonic immobility (TI). TI was induced by placing the chick on its back with the head hanging in a U-shaped wooden cradle. The number of attempts to induce tonic immobility and the duration of tonic immobility were recorded, each chick was given a maximum duration of 300 seconds. Also, on Day 5, 10 birds per treatment (out of the 15 used for TI) were subjected to an open field test. The latency to explore box, attempts to escape by the birds were also recorded. Data were analysed using a Kruskal-Wallis test in IBM SPSS package. Playback call had no significant effect ($P>0.05$) on the number of attempts to induce tonic immobility, duration of tonic immobility, number of escape attempt and percentage of box explored. In conclusion, this study shows pre-natal playback calls did not influence the level of fear in slow growing FUNAAB Alpha broiler chicks.

Effect of environmental enrichments on the behaviour of Nigerian indigenous chickens

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Nigerian indigenous chickens are mostly reared by the rural poor and the birds scavenge for their food and find places to roost at night around their owners' house. Rearing chickens and other poultry species in impoverished environments can seriously compromise their welfare and productivity. This research was carried out to investigate the effect of environmental enrichment on some behavioural attributes of Nigeria indigenous chickens reared under two environmental enrichment conditions. This work conforms to the Animal Care and Use Committee of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta Nigeria. A total of 56 matured Nigeria Indigenous Chickens (NIC), the Yoruba ecotype comprising of 8 cocks and 48 hens with an average age of 18 months were used for this study which have previously been raised without any form of enrichment materials except for the provision of nest boxes. Birds were housed in eight deep litter pens comprising of two enrichment conditions (enriched and unenriched). Birds in pens 1, 3, 5 and 7 were provided with enrichment materials (elevated perches and sand bath) for the first four weeks, birds were then switched to a different condition (i.e. from enriched to unenriched and vice versa for pens 2, 4, 6 and 8). One cock and six hens were randomly allotted to each pen (2m × 5m) and their behaviours monitored with CCTV cameras between 12:00-14:00h) daily for five days per week for the eight-week experimental period. Using a 5 mins scan sampling interval, the percentage of birds exhibiting feeding, drinking, foraging, standing, sitting, perching, nesting, mating and wing drooping were recorded. Behavioural data (feeding, drinking, foraging, standing, sitting, perching, nesting, mating and wing drooping) extracted from the video playback were analysed using Independent T tests or Mann Whitney U tests. During the first four weeks, environmental enrichment had no effect ($P > 0.05$) on walking and reproductive-related behaviour (nesting and mating), but perching was greater ($P > 0.05$) in the enriched than unenriched housing condition. The only opportunity for birds to perch in the unenriched condition was on top of the nest boxes. There was a tendency for oral-related behaviour (feeding, foraging and drinking) to be greater in the unenriched than enriched conditions. Inactive behaviour (standing and sitting) was greater in enriched than unenriched conditions. From the 5-8th week, there was a significant effect of environmental enrichment on walking, oral-related and inactive behaviour ($P < 0.05$), with higher percentages observed in the unenriched than enriched housing condition. Also, there was significant effect of environmental enrichment on perching behaviour ($P < 0.05$) with a higher percentage observed in the enriched condition while environmental enrichment had no significant effect on maintenance and reproductive-related behaviour ($P > 0.05$). In conclusion, environmental enrichment did not influence oral, maintenance and reproductive-related behaviours. This study did not consider frustration-like behaviours (feather pecking or aggression) which could be associated with the change in environment from enriched to unenriched conditions.

The effect of COVID-19 lockdown restrictions on anxiety-related behaviour in semi-captive African elephants

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African elephants used in the tourism industry are routinely exposed to high numbers of tourists, tourists within a close proximity, and tourist interactions, which are known to cause stress in both captive and wild populations, and can negatively affect health, welfare, and fitness. The impact of tourism is typically constant, with fluctuation occurring only in line with seasonal demand. However, the COVID-19 pandemic resulted in the sudden and prolonged absence of tourists at animal-interaction facilities, and thus provided a unique study opportunity to observe differences in elephant behaviour. We examined the impact of this abrupt change on 10 semi-captive African elephants (8 females, 2 males; ages 12-30 yrs) housed at Knysna Elephant Park, an elephant tourism venue in the Western Cape of South Africa which offers a variety of close-contact experiences (feeding, touching, and walks). We monitored the rate of primarily trunk-related self-directed behaviours (SDBs), a form of displacement activity and novel behavioural indicator of anxiety or short-term stress in this species, before and after lockdown was implemented. Using a combination of instantaneous and interval sampling, each individual was focal followed for a period of 30 minutes, twice a day. SDBs were recorded as they occurred, and numbers of tourists during the sample period were noted. South Africa entered a nationwide lockdown on 23rd March 2020, data examined represented 1-month pre-lockdown (February-March), where tourist pressure was high, and 1-month post-lockdown implementation (March-April), where tourist pressure was non-existent. A Linear Mixed Effects model was run with lockdown phase (pre- and post-implementation), age class, and sex entered as fixed factors, and elephant identity as a random factor. Results revealed that SDB rates were significantly lower post-lockdown implementation (LS-mean = 8.42) compared to pre-lockdown (LS-mean = 24.83; $t = -5.125$, $p < .001$), indicating a reduction in the short-term stress or anxiety experienced by this population due to the absence of tourists. Furthermore, the expression of SDBs did not differ between age class, sex, and elephant ($p > .05$). The findings of this study highlight the stressful effect of tourist presence and human-elephant interactions on elephant welfare, which has ramifications for the management of anthropogenic impacts on this species. They also provide additional evidence that SDBs can be used to monitor anxiety-inducing situations experienced by elephants and supports the establishment of SDBs as an elephant behavioural welfare index. Moreover, since SDBs are observed in both captive and wild populations, the behaviour set can be used as a non-invasive, reliable welfare assessment in various settings, and has application potential in human-elephant conflict mitigation strategies.

Posters

Presenter	Title
<i>Ojelade Oluwaseun</i>	<i>Effect of varying photoperiod regime on the growth rate, behavioural activities and physiological response of <i>Clarias gariepinus</i></i>
<i>Popoola, Moshood</i>	<i>Relationships between agonistic behaviour and physical traits in Nigerian indigenous rams</i>
<i>Oluyemi, Ayoola</i>	<i>Effect of environmental enrichment on performance and behavioural response in pigs</i>
<i>Oso Oluwadamilola</i>	<i>Post hatch behavioural and welfare responses of slow growing broilers</i>
<i>Ehigbor Tunmise</i>	<i>How do goats react during reunion after a short term separation</i>
<i>Dr Durosaro Samuel</i>	<i>Genotypic differences in fear response of meat type chickens</i>

Effect of varying photoperiod regime on the growth rate, behavioural activities and physiological response of *Clarias gariepinus*

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Research on photoperiod manipulation has always centred on improving the growth rate of *Clarias gariepinus* (African catfish), with little or no research on its influence on the behaviour, physiology and welfare of this fish species. This study evaluated the growth rate, survival rate, behavioural activities, and physiological response of one hundred and eight juveniles of *C. gariepinus* with an average weight of 21.7 ± 1.88 g, stocked at 12 fish/tank (1.7m \times 1.2m \times 1.0m) in triplicates and exposed to no period of light T1 (0L:24D), average period of light T2 (12L:12D) and continuous period of light T3 (24L: 0D) for 35-days. The 24L was illuminated with a 40W fluorescent lamp. Feed intake, growth and survival rate were monitored during the experiment. Behavioural traits were observed by direct observation for 10-minutes bi-weekly, while blood samples were collected at the end of the experimental period for glucose analysis. Normality of data was tested with Shapiro-Wilk and subsequently analysed with the Kruskal-Wallis test. The result of this study indicated that photoperiod regime affected ($\chi^2=0.99$, $df = 2$, $p=0.04$) the survival rate of *C. gariepinus* with the highest ($p<0.05$) mortality rate in T3. The feed intake was not significant ($P>0.05$) between the treatments. However, the mean weight gain (MWG) was significant ($\chi^2=21.3$, $df = 2$, $p=0.02$) at the three photoperiod regimes, with the highest (42.9 ± 3.11) and least (31.0 ± 2.56) MWG in T1 and T2 respectively. Other growth indices such as specific growth rate (SGR) and feed conversion ratio (FCR) were significant ($P<0.01$) across treatment with the highest in T1 for the juveniles of *C. gariepinus*. The duration of active swimming ($\chi^2=232.66$, $df = 2$, $p<0.01$), cohesion time at the bottom of the tank ($\chi^2= 249.95\pm 3.08$, $df = 2$, $p<0.01$) and rate of air gulping ($\chi^2=12.26$, $df = 2$, $p<0.01$) by the fish species were significantly different at the different photoperiod regimes. Highest duration of active swimming (383.4 ± 5.98), cohesion time at the bottom of the tank (297.6 ± 4.11), and rate of air gulping (10.5 ± 0.92) were found at T3, T2 and T3, respectively. Physiologically, photoperiod manipulation ($\chi^2=35.83$, $df = 2$, $p=0.002$) altered the glucose level of the fish species with the highest in T3 (58.7mg/dl) and least in T1 (41.3mg/dl). In conclusion, a photoperiod regime of no period of light positively affected the growth indices of juveniles of *Clarias gariepinus*, and physiologically the welfare of fish species at this photoperiod regime was not compromised. Thus, a photoperiod regime of total darkness is recommended for aquaculturists during the culture of juveniles of *Clarias gariepinus* for a higher growth rate within a short time without compromising the growth indices, behaviour and physiology of *C. gariepinus*.

Relationships between agonistic behaviour and physical traits in Nigerian indigenous rams

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In a wide spectrum of mammals, agonistic behaviour plays a significant role in deciding access to resources such as food, shelter, and mates, as well as establishing dominant position. Understanding species-specific characteristics in animal agonistic behaviour and social tolerance has conservation, management, and production implications. Aggression in animals serve to establish dominance relationships which may also facilitate formation of social hierarchies. Herd management entails essential considerations such as herd hierarchical structure, which necessitates a grasp of animal social organization's qualities, functions, and characteristics. This aids in the efficient control of flock groups and the effective administration of production systems. Sheep are social animals that show frequent interactions to establish affiliative relationships to gain rights over resources. The flock hierarchy in sheep affects access to resources, for instance, ability to have access to food resources by sheep alters the quality and amount of forage species gathered as well as nutritional intake. This study was conducted to assess the relationships between agonistic behaviour and physical traits in Nigerian indigenous rams. Rams were purposively considered for the study because of their aggressive behaviour and presence of some traits such as horns which are absent in Nigerian ewe populations. Four hundred adult rams of age range 2-3 years comprising of 100 rams from each indigenous breeds of sheep in Nigeria; these breeds are Uda, Yankasa, Balami and West African Dwarf (WAD) sheep. Data were collected on qualitative traits such as neck length, horn orientation, neck thickness, horn shape, body size, facial profile, rump profile of the animals and their agonistic behaviour such as pushing, charging, front kick, forward swing, butting, head push, threat, submission and circling. These rams were observed intermittently for 9 months in herds and on fields during different activities by these animals. The qualitative traits were obtained from the sampled rams by scoring them for visible traits as described in the checklist for phenotypic characterization of sheep and goat of Food and Agriculture Organization. Data on agonistic behaviour of the rams were scored Data were subjected to Chi-square analysis to test the relationship between the physical traits and agonistic behaviour of the animals. Results showed significant relationships ($p < 0.05$) between the selected phenotypic traits of rams such as body size, horn size, neck thickness, neck length, horn shape, horn orientation, face profile and rump profile and their agonistic behaviour such as pushing, kicking, butting, head push, circling and kicking. Relationships between body size, rump profile and kicking ability of the animal was also significant ($p < 0.05$). However, there was no significant relationship ($p > 0.05$) between horn size, neck thickness, neck length, horn shape, horn orientation and face profile of the animal. The significant relationships between some of the phenotypic traits of the rams and their agonistic attributes imply that those phenotypic traits contribute to the establishment of their social (dominant) hierarchy. Thus, selection of these rams for aggressiveness (less or more) could be done through phenotypic measures. Furthermore, social hierarchy established by these animals maybe associated with unequal access to resources such as food, water, space and even female animals for mating. As a result, the need for farmers to provide adequate resources, select the less aggressive rams and separate them from those

that are more aggressive in order to prevent the animals from injuring one another and for the weak animals to be managed separately.

Behavioural and Growth Performance Response of Pigs to Different Types and Numbers of Environmental Enrichment

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Rearing pigs intensively has greatly altered the behavioural repertoire of the animals, leading to frustration eliciting agonistic behaviours in pigs. This is due to lack of stimulus to perform inherent activities such as foraging and exploration in confined housing. These negative behaviours can be curtailed by providing environmental stimuli essential to attain physiological and psychological well-being. Hence, this study was conducted to determine the effects of different hung enrichment objects on the performance and behaviour of weaned pigs. A total of 63 (Largewhite X Landrace) mixed sex weaned pigs of 8 weeks old (10 ± 0.5 Kg) were allotted into seven treatments, with three replicates of three animals per replicate in a completely randomised design for eight weeks. A total of 63 (Largewhite X Landrace) weaned pigs were allotted into seven treatments, with three replicates of three animals per replicate in a completely randomised design for eight weeks. Two types of objects were presented: polyester rope (PR) and soft wood (SW). The PR used was 12mm, blue, open ended and knotted at intervals, while the SW was 40 x 4.0 x 4.5cm and suspended on each side by 6mm blue PR to enhance manipulation by the animals and prevent soiling. These objects were hung from the roof to the shoulder height of the experimental animals. The treatments were: control treatment (Control, without enrichment), treatment 2 (R1, one PR), treatment 3 (R2, two PRs), treatment 4 (R3, three PRs), treatment 5 (W1, one SW), treatment 6 (W2, two SWs) and treatment 7 (W3, three SWs) arranged in a 2 x 3+1 augmented factorial design. Behavioural observations were monitored using CCTV attached to the pens, measuring Pen-Mate Manipulation (PMM), Pen Component Manipulation (PCM) and Enrichment Use (EU) using standard procedures. These determine the level of interaction with objects provided and exhibition of inherent behaviour. Growth performance data were collected on initial weight, feed intake (FI), weight gain (WG) and final weight (FW) and Feed Conversion Ratio (FCR) was calculated. Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$. The highest PMM (30.01%) and PCM (40.28%) were observed among pigs in control while the least PMM (12.02%) and PCM (14.05%) were with pigs in W3. The highest EU (48.98%) was in W3 followed by W2, R3, R2 and W1 with 35.01%, 31.05%, 22.50%, 17.61%, respectively and the least (12.12%) in R1. Highest average WG (10.39kg) and FI (32.58) was observed with pigs in W2 with the least 8.86kg and 29.16 respectively, in R1. Conversely, there were no significant differences in FCR for all the treatments. When the main effect of object type (PR and SW) on behaviour was assessed compared with control (without enrichment), it was observed that PMM was significantly higher ($p < 0.05$) in the control (30.01%) than 21.74% and 16.89% for PR and SW groups respectively. PCM followed the same trend. The EU for SW (35.05%) was significantly ($p < 0.05$) higher when compared with 21.87% of PR. The main effect of numbers of objects on behavioural pattern indicated that as the number of enrichment objects increased, the PMM and PCM decreased with significant variation ($p < 0.05$) across the treatments with (24.24%, 31.78%, 29.25%), (18.71%, 23.43%, 27.95%), (14.91%, 18.44%, 25.69%) respectively for 1 object, 2 objects and 3 objects, while the EU increases as the number of enrichment device increased with 14.73%, 29.92% and 40.96% for 1 object, 2 objects and 3 objects respectively. It is therefore concluded that the use of SW and PR in this study can reduce PMM and PCM. Likewise,

as EU increases, appropriate stimulus that diverted the attention of pigs from PMM and PCM was elicited. These indicated that, provision of enrichment objects was capable of reducing agonistic behaviour towards the pen mates and pen components thereby improving the welfare of pigs in this study. Soft wood was preferred by weaned pigs in this study.

Post Hatch Behavioural and Welfare Responses of Slow Growing Broiler Chickens to Varying Onset of Photo-stimulation during Incubation

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Photo-stimulation during incubation influences the establishment of biological rhythms. There are indications that melatonin rhythms during incubation can influence hatching event, behaviour and stress response of poultry. However, it is unclear how this manipulation impacts post hatch welfare and behavioural status of the birds. A total of 500 Sasso broiler eggs were assigned into 4 treatments. Hatching eggs were incubated in the dark throughout incubation (Tdark) while TL1-21, TL7-21, and TL14-21 were exposed to light (12L:12D) from day 1, 7, and 14 of incubation, respectively until hatch. The eggs were photo-stimulated using a 6,500k cool LED at 788 clux light intensity at egg level. Birds were raised in 5 replicates per treatment, 16 birds per replicate. Birds in (Tdark) were raised conventionally while TL1-21, TL7-21, and TL14-21 birds were reared using 6,500k LED (at 28 clux) using a photoperiod of 16L:8D in a completely randomized design. Fear (emergence test, tonic immobility, isolation and inversion tests) and stress responses (physical and composite asymmetry) were examined. Behaviour of the birds was recorded 4 hours per day (3 days recording per week). Behavioural repertoires were obtained from the recording by adopting the scan sampling method with the aid of an ethogram. At the 12th week of age, there was no significant difference in locomotory, comfort and aggressive behaviours of the birds. Increased frequency of feeding behaviour was observed in TL1-21 when compared to TL7-21 and TL14-21 birds. Drinking, inactivity, preening behaviours and litter pecking were higher in Tdark and TL1-21 when compared to TL14-21. Latency to emerge was higher in Tdark compared TL7-21 and TL14-21 while tonic immobility responses, physical asymmetry and composite asymmetry were higher in Tdark compared to other treatment groups. Frequency of isolation vocalization was higher in Tdark compared to TL1-21. In conclusion, initiating embryonic photo-stimulation at varying phases of development did not impair behaviour of birds but it reduced their stress and fear responses.

Ethical statement: This study was carried out according to welfare ethics which conforms to with ISAE ethical guidelines.

How do goats react during reunion after a short term separation?

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For optimal milk collection, kids are temporarily separated from their dams. This practice has implications on dam-kid relationships. Maternal bonding is often established soon after birth, therefore, short or long-term separation may disrupt the bond between mother and offspring and further lead to problems pertaining to animal welfare. This work conforms to the Animal Care and Use Committee of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta Nigeria. Twelve West African Dwarf (WAD) goats reared at a smallholder dairy goat farm unit were used to investigate the behavioural responses during reunion of dams and kids after short-term separation. The kids (5-7 weeks of age) were separated from their dams for 10 minutes on the day of data collection, to evaluate the effect of this short term separation of kids from their dams (already published) but here we will report the behaviour of the dams and kids for the first five minutes of reunion (i.e. period the kids were reintroduced to their respective dams). The behaviour was analysed subsequently by watching the playback of the video. During the playback, percentage of dams that displayed behaviours such as sniffing, grooming, tail wagging event, initiation of end of suckling were recorded. For the kids, behaviours such as suckling duration, frequency of successful suckling, frequency of unsuccessful suckling, the number of kids with unsuccessful attempts to re-suckle, tail wagging event, initiation of end of suckling were recorded. Data was analysed using descriptive analysis. Result from this study shows that 67% of the WAD dams sniffed their kids' genitalia, and only 8% of them groomed their kids upon reunion. Tail wagging behaviour was observed in 8% of the WAD dams after allowing the kids to suckle. End of suckling was initiated by 75% of the dams by sudden movement away from the kids. As for the kids, the average suckling duration was 24 seconds, only 92% of the kids were able to successfully suckle after reunion, and 8% of the kids did not suckle at all. After the end of the first suckling period by the 92% kids who were allowed to suckle by their dams, 82% of them made another attempt to re-suckle their dams but were rejected. Tail wagging was observed mostly in the kids at different periods, such that 50% of the kids wagged their tails during suckling, 25% of the kids wagged their tails before and during suckling, 8% of the kids wagged its tail during and after suckling, while 17% did not display tail wagging behaviour at all. End of suckling was initiated by 8% of the kids by moving away from the dam completely without making another attempt to re-suckle. This observational study adds to the literature on the common behaviours in response to reunion after a short-term separation. There is the possibility that tail wagging in kids during reunion is an indicator of positive welfare.

Genotypic differences in fear response of meat type FUNAAB Alpha chickens in the first week of life

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The meat type FUNAAB Alpha chicken was developed in Nigeria through rigorous, systematic and selective breeding of Nigerian indigenous chickens without eroding their tropical adaptive features such as disease resistance and heat tolerance. The meat type FUNAAB Alpha chickens have three genotypes which are normal feather, naked neck and frizzle feather. Selection responses for fear have been studied in a number of meat type chickens but few studies are available on FUNAAB Alpha chickens. Freezing responses to fearful stimuli are used by birds for survival in a prey-predator system. This study examined the genotypic differences in tonic immobility duration and number of attempts to induce tonic immobility in meat type FUNAAB Alpha chickens in the first week of life. The protocol used for the experiment was according to Animal Care and Use Committee of College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. One hundred and two (102) meat type FUNAAB Alpha chickens (34 each of normal feather, naked neck and frizzle feather) were used for the experiment which lasted for 7 days. All the birds were raised together in the same pen. The duration of tonic immobility (TID) and number of attempts to induce tonic immobility (TIN) were measured in all the birds. The maximum allotted time for TI was 300 seconds. The TID and TIN were measured at 1, 3, 5 and 7 days of life, respectively. The data collected on TID and TIN were analysed using Kruskal-Wallis tests. There was a significant genotype effect on TID at days 1 and 7 ($\chi^2 = 8.8879$, $df = 2$, $p = 0.02$ and $\chi^2 = 8.4192$, $df = 2$, $p = 0.02$, respectively). The TIN was significantly affected by genotype at day 3 ($\chi^2 = 10.1606$, $df = 2$, $p = 0.01$). There was a significant ($p < 0.05$) difference in the TID of normal feather and frizzle chicks at one-day old. There was no significant ($p > 0.05$) difference in TIN of normal feather and frizzle feather chicks at 3rd day of life. It can be concluded that genotype has effect on TID and TIN of meat type FUNAAB Alpha chickens with normal feather chickens being more fearful than frizzle feather, and normal feather chickens and naked neck chickens being intermediate at day 1. The normal feather and frizzle feather chickens have the same fear response at 7th day of life. The normal feather chickens were consistently more fearful than other genotypes in the first week of life. Environmental enrichment materials such as perches, sand baths, and play materials should be provided at early life for normal feather meat type FUNAAB Alpha chickens to reduce their fearfulness and improve their productivity.