



STUDYING THE BEHAVIOUR AND PERFORMANCE OF BALADY MALE GOATS MANAGED IN DIFFERENT GROUP SIZES WITH THE SAME INDIVIDUAL FLOOR SPACE UNDER EGYPTIAN CONDITIONS

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ABSTRACT

The objective of this study was to evaluate the effects of different group size on behaviour and performance of male goats. Twenty eight castrated balady male goats, with an initial average body weight (BW) of 19 kg at 6 months old age, were used in this experiment. There were four different densities with 4, 6, 8, 10 animals in four experimental pens (6, 9, 12 and 15 m², respectively) with the same space allowance of 1.5 m² per buck. The results indicated that ingestive behaviour (eating, drinking and rumination), walking and comfort behaviour were significantly higher with increasing the group size, and nevertheless resting (lying, drowsiness and sleeping) and idling times were significant higher with small group size. Moreover, eliminative behaviour was significantly affected by group size. Aggressive behaviour was increased linearly with group size, while vocalization was increased with the decrease of group size. On the other hand, the most parameters of performance representing in BW gain (kg), AD gain (g) and gain: feed were significantly higher under large group size. In conclusion, the group size as managerial practice in management of goats has effects on performance and different pattern of behaviour, where large group size increases the performance and some of maintenance behaviour.

KEY WORDS: behaviour, group size, male goats, performance.

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1. INTRODUCTION

In recent years, goat farming has become more and more popular in industrial countries. Part of this development is due to the growing amount of people developing allergic reactions to cow's milk and looking for an alternative milk and milk product supply. Due to goat products still being a niche product on the market as well as delicatessen, they can be sold at a higher price, making goat keeping also interesting from an economic point of view. All movements and body positions as well as the results of muscle contraction (odours and sounds) are part of the behavioural pattern of an animal (1). Results of behavioural studies could be used in evaluation of welfare conditions

created by man as well as evaluation of psychical features which determine the usefulness for specific utility type (2). Behaving synchronously is considered to be an important benefit of living in groups, since it may increase the safety of the individual. Groups with goats can vary widely in size, depending on the local environment conditions and the characteristic of the population. Among feral goats, the groups normally consists of 2 to 10 individuals, but in some populations, the group size might have a wide range from 50 to 100 individuals (3). The female and their juvenile offspring will form groups on a home range, while males will get separate from the female

groups and form smaller group and share home range with the female groups (4). The greatest benefit of living in groups is the reduced predation risk through individual's risk of being attacked decreases with increasing group size (5) and have the benefit of obtaining food that would not be obtainable otherwise, and food sources can be defended if necessary (6). Farm animals are rarely exposed to predators, but have still maintained a strong anti-predator behaviour through the domestication (7) and they show lower fear when grouped. Because of the increased group size each individual will have more time to forage and rest than to look for predators (8). Detecting food can be easier when living in groups than solitary through uses the social information from other goats to locate better foraging areas (9). In contrary, in other studies found that, the living in groups leads to the competition for the resources as food, mates and attractive resting places (10) and spending more time searching for food to support the whole group (8, 11). And, unfortunately, scientific information about how size and organization of lying space affects the behaviour and social interactions in goats is scarce. When resources are limited there will be a higher competition and the level of aggression through the social interactions will increase as a result of this (12) and for farm animals these resources may be feeding or drinking space, access to litter or straw, attractive resting places and the freedom to move itself if the overall space is limited. Although resting pattern may not appear to be the most important indicator of the welfare status, farm animals tend to show a very synchronous activity and resting pattern if the environmental conditions allow it (13, 14). Therefore, the objectives of the present experiment are to summarize the method of management of male goats under different group size with the same floor space on its behaviour and performance.

2. MATERIAL AND METHOD

2.1. *Experimental animals and management*

The effect of different group sizes on behaviour and performance of animals was investigated by using 28 castrated balady male goats', approximately similar age (6 months) and body Weight (19 kg), in the animal farm at Faculty of Veterinary Medicine, Zagazig University. There were four different densities with 4, 6, 8, 10 animals in four experimental pens (6, 9, 12 and 15 m², respectively) with the same space allowance of 1.5 m² per buck. These pens were natural ventilated by windows, moreover natural sources of day light throughout the experimental period (3 months). Each pen had facility of mangers and the plastic buckets were placed for the availability of fresh drinking water. The animals were fed two times; at 8:00 am and 1:00 pm. During morning feeding (at 8:00 am), they were given standard concentrate mixture (58% yellow corn, 22% wheat bran, 18% soybean meal, 0.5%, dicalcium phosphate, 1% NaCl and 0.5% premix and) with 0.5 kg concentrate / day / buck, while afternoon feeding was barseem (0.5 kg hay / day / buck). Fresh water was available ad libitum consumption throughout the study.

2.2. *Data recording and measurement:*

One week was given to animals to accustom to the different pen treatments before collecting data, after that behaviour and performance were recorded throughout experimental period. The performance data was represented in the feed intake (concentrate and hay) and body weight (BW). Feed intake (concentrate and hay) was offered to animals in each group daily and measured in the next morning throughout the study period to calculate voluntary feed intake (DMI). The body weights of all animals were taken initially and thereafter every two weeks intervals. Hence, calculate average daily gain

(ADG). The behavioural observation was done using focal sample technique (15) through direct observation with 3 minutes intervals to calculate the mean times and frequencies of each behaviour for 8 hours / each group / month throughout the experimental period. The observed behavioral traits as mentioned by (16) were as following:

- 1- Feeding behaviour: including eating, drinking and rumination times.
- 2- Resting behaviour: including lying, drowsiness and sleeping times.
- 3- Comfort behaviour: including the frequencies of self-groom, mutual grooming and yawning.
- 4- Eliminative behaviour: frequencies of urination and defecation.
- 5- Agonistic behaviour: including the frequencies of threat, butting and fighting.
- 6- Other behaviour: including standing, walking and idling times
- 7- Communication among animals through its vocalization.

2.3. Statistical analysis:

Table 1. Duration of Ingestive, Resting and other behaviours (\pm SE) under different group size in goats (Minutes / 8 hrs.).

Behavioural parameters	Group 4	Group 6	Group 8	Group 10
<u>Ingestive behaviour</u>				
Eating time	125.50 \pm 7.24 ^b	159.32 \pm 9.20 ^a	162.23 \pm 9.36 ^a	164.08 \pm 9.47 ^a
Drinking time	0.48 \pm 0.02 ^c	0.40 \pm 0.02 ^a	0.83 \pm 0.04 ^b	1.03 \pm 0.06 ^a
Rumination time	79.45 \pm 4.58 ^b	42.59 \pm 1.82 ^c	90.47 \pm 5.22 ^b	119.38 \pm 6.89 ^a
<u>Resting behaviour</u>				
Lying time	114.57 \pm 6.61 ^a	100.45 \pm 5.78 ^{ab}	92.02 \pm 5.31 ^b	24.70 \pm 1.43 ^c
Drowsiness time	33.22 \pm 1.91 ^a	28.40 \pm 1.36 ^b	18.10 \pm 1.04 ^c	4.20 \pm 0.24 ^d
Sleeping time	19.83 \pm 1.15 ^a	16.45 \pm 0.95 ^b	4.35 \pm 0.25 ^c	0.00 \pm 0.00 ^d
<u>Other behaviours</u>				
Standing time	131.82 \pm 7.31	126.37 \pm 7.32	126.60 \pm 7.31	126.22 \pm 7.29
Walking time	20.35 \pm 1.17 ^c	21.02 \pm 1.21 ^c	29.88 \pm 1.72 ^b	48.92 \pm 2.82 ^a
Idling time	30.35 \pm 1.75 ^a	20.60 \pm 1.19 ^b	0.00 \pm 0.00 ^c	0.48 \pm 0.02 ^c

^{abcd} Means in the same row with different superscripts are significantly different at ($P < 0.05$).

The obtained data in this study were statistically analyzed for variance ANOVA, LSD (Least significant difference) according to (17). Differences among treatment means were compared using Duncan's multiple range tests (18). Data were presented as Mean \pm SE and significance was declared at ($P < 0.05$).

3. RESULTS AND DISCUSSION

The main results from the present study showed that, most behavioural patterns and performance in goats were more dependent on group size. Results in table (1) revealed that eating, drinking and rumination times were linear increased with group size, with significance differences, as mentioned by (19) who found that feeding time and rate of foraging in goats increased with group size to about 12 goats because of a reduction in time devoted to alert behavior. The increase number of animals in the pens increased feed and water intake, as mentioned by (20). Nevertheless, other studies found that, a larger group size decreased synchrony in

Table 2. Frequencies of Eliminative and Comfort behaviour (\pm SE) under different group size in goats (Frequencies /8 hrs.).

Behavioural parameters	Group 4	Group 6	Group 8	Group 10
<u>Eliminative behaviour</u>				
Urination frequency	2.00 \pm 0.11 ^c	10.00 \pm 0.58 ^a	7.00 \pm 0.40 ^b	8.00 \pm 0.46 ^b
Defecation frequency	1.00 \pm 0.06 ^d	9.00 \pm 0.52 ^a	2.00 \pm 0.11 ^c	3.00 \pm 0.17 ^b
<u>Comfort behaviour</u>				
Self-grooming	2.67 \pm 0.33 ^c	3.62 \pm 0.21 ^b	4.68 \pm 0.29 ^a	4.10 \pm 0.24 ^b
Mutual grooming	0.60 \pm 0.03 ^c	0.98 \pm 0.05 ^b	0.95 \pm 0.05 ^b	1.18 \pm 0.06 ^a
Yawing	1.00 \pm 0.05 ^c	1.00 \pm 0.05 ^c	6.00 \pm 0.35 ^a	3.00 \pm 0.17 ^b

^{abcd} Means in the same row with different superscripts are significantly different at ($P < 0.05$).

feeding behaviour (21) and reduced the time spent queuing in front of the feed barrier (22). The increase in rumination time in large group was maybe due to high roughage feed intake, as according to (23, 24), who

cited that rumination was increased linearly with high hay intake. While resting behaviour, representing in lying, drowsiness and sleeping times was significantly declined in large group size, which were

Table 3. Frequencies of Agonistic behaviour and Vocalization (\pm SE) under different group size in goats (Frequencies / 8 hrs.).

Behavioural parameters	Group 4	Group 6	Group 8	Group 10
<u>Agonistic behaviour</u>				
Threat frequency	0.00 \pm 0.00 ^c	5.00 \pm 0.29 ^b	4.00 \pm 0.23 ^b	20.00 \pm 1.15 ^a
Butting frequency	7.00 \pm 0.40 ^c	50.00 \pm 2.89 ^b	198.00 \pm 11.43 ^a	190.00 \pm 10.97 ^a
Fighting frequency	1.30 \pm 0.07 ^c	7.39 \pm 0.42 ^b	11.11 \pm 0.64 ^b	45.47 \pm 2.62 ^a
Vocalization frequency	42.00 \pm 2.42 ^a	5.00 \pm 0.29 ^b	0.00 \pm 0.00 ^c	0.00 \pm 0.00 ^c

^{abc} Means in the same row with different superscripts are significantly different at ($P < 0.05$).

Table (4): Some performance parameters of goats managed under different group size (Mean± SE).

Parameter	Group 4	Group 6	Group 8	Group 10
Initial BW, kg	18.96±0.51	19.03±0.45	18.99±0.56	19.07±0.46
Final BW, kg	20.67±0.38	20.82±0.26	21.29±0.41	21.77±0.42
Total BW gain, kg	1.71±0.12 ^c	1.79±0.18 ^{bc}	2.29±0.15 ^{ab}	2.70±0.05 ^a
ADG, g	30.53±3.89 ^c	32.02±3.24 ^{bc}	41.01±2.67 ^{ab}	48.18±0.97 ^a
Berseem hay, g	312.63±12.91	324.48±31.11	337.82±66.82	370.42±19.59
Concentrate, g	437.21±3.44 ^b	438.03±4.01 ^b	451.67±4.64 ^a	457.11±4.39 ^a
Daily DMI, g	749.84±10.53	762.51±34.76	789.50±20.44	827.53±23.71
Gain: feed	4.06±0.47 ^c	4.18±0.23 ^{bc}	5.18±0.25 ^{ab}	5.83±0.23 ^a

^{abc} Means in the same row with different superscripts are significantly different at ($P < 0.05$).

agreed with (22). It may be due to a lower level of social activity in the largest group size (25). However, in contrast the behavioural synchrony declines as group size increases, making more time available behaviour, this is in according to (27), who found that significantly increase linearly with declining the group size. In contrast, activity of bucks representing in walking time was increased significantly under the large group, where it may be due to negative correlation between resting and walking time (28). The same was reported by (19), who recorded the high movement rate positively with increase group size. Large group housing also provides improved access to space that, together with social contact, facilitates the expression of play behaviour (29).

Eliminative behaviour (urination and defecation frequencies), as mentioned in Table (2) was significantly affected by group size, where it was the highest in group 6 and the lowest in group 4. Other results in Table (2) revealed positive correlation between frequency of comfort

for feeding and resting (26). Animals in small group stand for longer time than those in large group, but the difference was not significant. Furthermore, the bucks stand without any activities as idling behaviour (self-grooming, mutual grooming and yawning) and group size, with significance differences among the groups. This result may be due to allelomimetic behaviour among bucks in large groups.

The most prevalent aggressive interaction was the frequencies of threaten, butting and fighting. In general, the level of aggression, as in Table (3) was significantly higher in large group sizes compared to small group sizes which are in accordance with other studies (20, 21), who found that aggressive behaviour increased linearly by group size. However, other studies found that agonistic behavior between goats declined with increased group size (19). On the other hand, (22) observed that there were no effects of group size on aggressive interactions. Vocalization as a method of

communication among bucks, as mentioned in Table (3) was the highest in group 4 (42.00 ± 2.42^a) and group 6 (5.00 ± 0.29^b) with significant difference, while there is no vocalization in group 8 and 10. The total parameters of performance, as shown in Table (4) were increased linearly as group size increased with significance differences in total BW gain, ADG, Concentrate intake and feed conversion ration (Gain : Feed). These results may be due to high total time of ingestive behaviour which reflected in performance of animal, moreover group rearing allows for early social interactions (29) that have been shown to be important in the development of feed intake. (20), working with different sizes of groups of lambs found that the increasing the number of animals in stalls affects food intake with great variation in growth rate of animals. Furthermore, (29) cited that total feed intake increased linearly as group size increased ($P = 0.03$), while did not improve growth rate or feed conversion ratio.

In Conclusion, The results of this study showed that the number of animals per group influences the behavior of confined balady male goats. Where, the mean time ingestive, comfort, aggressive behaviour was significantly increased linearly by group size. However, in contrast the resting and vocalization behaviour were decreased in small groups. Excretion behaviour had significant differences among different group sizes. Furthermore, all performance parameters were higher in large group size. Hence, for sustainable good animal performance, further management under large group size with avoiding aggressive behaviour.

4. REFERENCES

1. **Sambraus, H.H., 1978.** Nutztierethologie, Das Verhalten landwirtschaftlicher Nutztiere – Eine angewandte Verhaltenskunde für die

Praxis, Verlag Paul Parey, Berlin Hamburg, 1. Auflage.

2. **Iulian, T.; Ludovic, T.C.; Marian, B.; Stelian, A.; Dinu, G. and Silvia, E., 2012.** The effect of space allowance on drinking and resting behaviour in six months of age calves. *Journal of Food, Agriculture & Environment* Vol.10 (2): 1356-1358.
3. **Shackleton, D.M. and Shank, C.C., 1984.** A review of the social behaviour of feral and wild sheep and goats. *J. Anim. Sci.* 58, 500-509.
4. **Dwyer, C., 2009.** The behaviour of sheep and goats. In: Jensen, P. (Eds.), *the ethology of domestic animals – an introductory text*. 2nd ed. CABI, Wallingford Cambridge, pp 161-177.
5. **Roberts, G., 1996.** Why individual vigilance declines as group size increases. *Anim. Behav.* 51: 1077-1086.
6. **Mendl, M. and Held, S., 2001.** Living in groups: an evolutionary perspective. In: Keeling, L.J., Gonyou, H.W. (Eds.), *Social behaviour in farm animals*. CABI Publishing, Wallingford Cambridge, pp. 7-36.
7. **Penning, P.D.; Parsons, A.J.; Newman, J.A.; Orr, R.J. and Harvey, A., 1993.** The effects of group size on grazing time in sheep. *Appl. Anim. Behav. Sci.* 37: 101-109.
8. **Krause, J. and Ruxton, G.D., 2002.** Living in groups. In: *Oxford Series in Ecology and Evolution*. Oxford University Press, Oxford, 210 pp.
9. **Shrader, A.M.; Kerley, G.I.H. and Brown, J.S., 2007.** Social influence of space feeding and competition in group-living goats. *Behav. Ecol.*, 18:103-107.
10. **Alcock, J., 1997.** *Animal Behavior – an evolutionary approach*. 6th ed. Sinauer Associates, Inc., Sunderland, Massachusetts, USA pp 555-602.

11. **Estevez, I.; Andersen, I.L. and Nævdal, E., 2007.** Group size, density and social dynamics in farm animals. *Appl. Anim. Behav. Sci.* 103: 185-204.
12. **Milinski, M. and Parker, G.A., 1991.** Competition for resources. In: J.R. Krebs and N.B. Davies (Eds.) *Behavioural ecology*. Blackwell Scientific, Oxford, pp.137-168.
13. **Rook, A.J. and Penning, P.D., 1991.** Synchronization of eating, ruminating, and idling activity by grazing sheep. *Appl. Anim. Behav. Sci.* 32: 157-166.
14. **Fraser, A. F. and Broom, D. M., 1997.** *Farm Animal Behaviour and Welfare* (3rd ed.), CAB Int., 435 pp.
15. **Dawkins, M.S., 2007.** *Observing animal behaviour*. United State, Oxford University, New york.
16. **Simone Szabö, 2008.** Behaviour of dairy goats in the collecting area - Influence of space allowance and shape. Master thesis, the Institute of Organic Farming, University of Veterinary Medicine (Vienna), Austria.
17. **Snedecor, G.W. and Cochran, W.G., 1982.** *Statistical methods*. 8th Ed., Ames. Iowa State University.
18. **Duncan, D.B., 1995.** Multiple range and multiple F-tests. *Biometrics* 11, 1-42.
19. **Kenneth, L.R. and James, A.B., 1985.** Relationships between group size, feeding time, and agonistic behavior of mountain goats. *Canadian Journal of Zoology*, 63(11): 2501-2506.
20. **Van, D.T.T.; Thi Mui, N. and Ledin, I., 2007.** Effect of group size on feed intake, aggressive behaviour and growth rate in goat kids and lambs. *Small Ruminant Research*, Vol. 72, p.187–196.
21. **Tölü, C. and Savas, T., 2007.** A brief report on intra-species aggressive biting in a goat herd. *Appl. Anim. Behav. Sci.*, 102,124-129.
22. **Jorgensen, G.H.M.; Andersen, I.L.; Berg, S. and Bøe, K.E., 2009.** Feeding, resting and social behaviour in ewes housed in two different group sizes. *Appl. Anim. Behav. Sci.* , vol. 116, no. 2, pp. 198-203.
23. **Dias, R. S.; Patino, H.O.; López, S.; Prates, E.; Swanson, C. and France, J., 2011.** Relationships between chewing behavior, digestibility, and digesta passage kinetics in steers fed oat hay at restricted and ad libitum intakes. *J. Anim. Sci.*, 89:1873-1880.
24. **Zhao, X. H.; Zhang, T.; Xu, M. and Yao, J.H., 2011.** Effects of physically effective fiber on chewing activity, ruminal fermentation, and digestibility in goats. *J Anim. Sci.*, 89:501-509.
25. **Andersen, I.L.; Tønnesen, H.; Estevez, I.; Cronin, G.M. and Bøe, K.E., 2011.** The relevance of group size on goats' social dynamics in a production environment. *Appl. Anim. Behav. Sci.* , vol. 134, Iss. 3, pp. 136-143.
26. **Boissy, A. and Dumont, B., 2002.** Interactions between social and feeding motivations on the grazing behaviour of herbivores: sheep more easily split into subgroups with family peers. *Appl. Anim. Behav. Sci.* 79, 233-245.
27. **Luciane, R.S.; Julio, V.; Leandro, S.F.; Ivan, L.B.; Flânia, M.A. and Juliano, B., 2011.** Behavior patterns of cows with Charolais or Nellore breed predominance fed diets with plant extract or monensin sodium. On-line version ISSN 1806-9290, *Revista Brasileira de zootecnia*, vol.40 no.12: 2954-2962.
28. **Morisse, J.P. and Maurice, R., 1997.** Influence of stocking density or group size on behaviour of fattening

rabbits kept under intensive conditions. *Appl. Anim. Behav. Sci.* vol. 54, no. 4, pp. 351-357.

- 29. Van, D.T.T., 2006.** Some Animal and Feed Factors Affecting Feed Intake, Behaviour and Performance of Small Ruminants. Doctoral thesis, Swedish University of Agricultural Sciences, Uppsala 2006.



دراسة سلوك وأداء ذكور الماعز البلدي تم تربيتها في مجموعات مختلفة الكثافة مع ثبات مساحة لكل ذكر تحت الظروف المصرية

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الملخص العربي

كان الهدف من هذه الدراسة هو تقييم آثار حجم المجموعة على سلوك وأداء ذكور الماعز. أجريت التجربة على 28 ذكر بلدي مخصي بمتوسط وزن 19 كجم وعمر 6 أشهر حيث تم تقسيمهم الى أربع مجموعات مختلفة الكثافة (4، 6، 8، 10) مع توفير المساحة المطلوبة لكل ذكر (1.5 متر²) في أربعة حجرات مختلفة المساحة (6 متر²، 9 متر²، 12 متر²، 15 متر²، مع الترتيب) في المزرعة الخاصة بكلية الطب البيطري، جامعة الزقازيق. تمت التجربة خلال ثلاثة أشهر حيث أشارت النتائج الى أن هناك زيادة معنوية في سلوك الاكل، الشرب، الاجترار، الراحة، المشي نتيجة لزيادة عدد أفراد المجموعة. بالإضافة لذلك، سجلت زيادة خطية في السلوك العدواني مع زيادة حجم المجموعة. على العكس، كان هناك زيادة ملحوظة في سلوك الراحة في المجموعات صغيرة الحجم مع وجود فرق معنوي. علاوة على ذلك، كان هناك زيادة معنوية في عدد مرات الصوت في ا لمجموعة صغيرة الحجم. في المقابل فإن معظم معايير الأداء التي تتمثل في الاستهلاك اليومي للعليقة، الزيادة في الوزن و معامل التحويل الغذائي كانت أعلى مع زيادة حجم المجموعة مع وجود فروق معنوية.

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