UNIVERSITI PUTRA MALAYSIA

THE EFFECT OF WATER RESTRICTION ON PERFORMANCE AND BEHAVIOUR OF BROILER BREEDERS

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By

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Dedicated to

My late father

My beloved mother, mother in law, father in law, lovely wife

and my brothers

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
D	Dark
GLM	General Linear Models
Hr.	Hour
H/d	Hour Per Day
g	Gram
L	Light
Ml/b	Milliliter Per Bird
S/P	Spot Pecking
S/W	Standing and Walking

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science.

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A study was carried out to investigate the effect of water restriction on various traits of broiler breeders under tropical conditions. The experimental treatment comprised of water available 24h/d and restricted to 8h/d and 6h/d.

Body weight for male and female birds were not affected by water restriction during the growing period. Body weight was reduced significantly during the production period for 6h/d compared with 24h/d but showed no difference with 8h/d. Flock uniformity was similar for all groups at week 21. Water intake was significantly higher in water available *ad libitum* either on or off feed day compared with restricted groups. Water intake of 8h/d was significantly higher than those on 6h/d on feed day, while there was no significant effect on off feed day.

There was no effect of water restriction on the percentage of birds spent standing and walking, resting, preening and spot pecking for all treatments, with the exception of scratching and pecking litter in which the water restricted treatments recorded higher proportion in this activity.

Egg production, egg weight and hatchability were reduced significantly by water restriction. Fertility and several defects of egg were not affected by water restriction.

Mortality was not affected during rearing, while in production periods mortality was significantly higher in the water restriction treatments.

The results of this study showed that water restriction could be used during the growing period, but not during the production periods, since water restriction had a detrimental effect on egg production and mortality.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains.

KESAN SEKATAN AIR KEATAS PRESTASI DAN KELAKUAN AYAM PEMBIAK PEDAGING

Oleh

MUSTAFA FADIL MOHAMMED

May 1998

Pengerusi: Profesor Madya Ramlah A. Hamid

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Satu kajian telah dijalankan untuk mengkaji kesan sekatan air keatas beberapa sifat ayam pembiak pedaging dibawah keadaan tropika. Perlakuan-perlakuan kajian ialah air tersedia ada, 24 jam/hari, dan sekatan selama 8 jam/hari dan 6 jam/hari.

Sekatan air tiada memberi kesan kepada berat badan ayam jantan dan betina diperingkat pembesaran. Berat badan berkurangan secara bererti semasa peringkat pengeluran untuk 6 jam/hari berbanding 24 jam/hari tetapi tiada perbezaan dengan 8 jam/hari. Keseragaman kelompok adalah sama untuk semua kumpulan pada minggu ke 21. Pengambilan air adalah tinggi secara bererti dengan kesediaan air secara bebas samaada pada hari diberi atau tiada diberi makanan berbaning kumpulan dihadkan pengambilan air.

Pengambilan air adalah tinggi secara bererti dengan 8 jam/hari daripada 6 jam/hari pada hari diberi makanan, sementara tiada kesan bererti pada hari tiada diberi makanan.

Sekatan air tiada memberi kesan keatas bahagian masa yang digunakan untuk berdiri dan berjalan, berihat, membersih bulu dan pematukan bagi semua perlakuan, melainkan mencakar dan mematuk bahan sarap dimana perlakuan sekatan air mencatitkak bahagian tinggi untuk aktiviti ini.

Pengeluaran telur, berat telur dan penetasan adalah berkurangan oleh sekatan air. Sekatan air tiada memberi kesan keatas kebernasan telur dan beberapa kecacatan telur.

Perlakuan sekatan air tiada memberi kesan keatas kematian semasa peringkat pembesaran, tetapi kematian adalah tinggi secara bererti semasa peringkat pengeluaran.

Keputusan kajian ini menunjukkan sekatan air boleh diamalkan semasa peringkat pembesaran tetapi tidak boleh diamalkan semasa peringkat pengeluaran, karena sekatan air memberi kesan yang buruk keatas pengeluaran telur dan kematian.

CHAPTER I

INTRODUCTION

Poultry is one of the world's major and fastest growing sources of meat, representing over 22% of all meat production in 1989 (Stenholm and Waggoner, 1991). Poultry farming constitutes a major livestock activity in Peninsular Malaysia. The poultry industry in this country had been able to transform itself from subsistence farming to a highly modern and efficient production system within a relatively short period of less than 30 years. Malaysia now produced more broiler and eggs than it can consume and the surplus are exported to Singapore (Ramlah, 1993).

The poultry industry passed through a period of steady expansion in the sixties and seventies and accelerated expansion in the eighties. Poultry meat production increased from 21,300 tonnes in 1960 to 314,000 tonnes in 1990. Egg production showed similar growth pattern from 208 million to 4700 million in 1990 (Jalaludin, 1993).

The structure of the poultry industry consists of breeding farms and hatcheries, commercial broiler and layer farms. The other supportive segments of this industry are the feedmills and feed ingredients suppliers, the pharmaceutical and equipment firms (Ramlah, 1993).

The management of broiler breeders is one of the demanding undertakings for the poultryman. A good feeding routine, excellent management of the litter and fine control of the environment are necessary to achieve satisfactory results. Good management can give up to 140 fertile eggs per bird but under poorer control the number may be barely 100 (Sainsbury, 1992).

In any litter-based system, birds defecate on the litter and the consequences of this are important. Thus the usual reaction of birds to loose litter is to peck and scratch in it. As a result, faeces do not simply accumulate but are dispersed. So litter management is very important in the management of broiler breeders (Sainsbury, 1992).

Broiler breeder hens have to be kept on a restricted feeding to control the growth rate of the pullets and thus achieve the target body weights at 18 to 20 weeks of age, and in general 6 to 10% below the expected weights of birds on full fed diets (Karunajeewa, 1987). When birds are given food *ad libitum* they overeat, become obese and showed reduced fertility.

Birds which are food deprived may show an increased drinking behaviour (Savory et al., 1992). The small amounts of excess water consumed could change the droppings from dry to wet (Maxwell and Lyle, 1957). This

results in wet droppings, wet litter, high concentrations of ammonia, and inhibits pecking and scratching and caused unpleasant conditions for birds and increased incidence of foot, hock and breast lesions (Appleby et al., 1992).

To avoid these consequences, the breeders' recommendations often suggest that water supply should be limited to only a few hours a day to prevent overdrinking and to reduce the opportunities for spillage.

Birds under high ambient temperature drink three times as much water as at normal ambient temperature (North, 1978; Leeson, 1986). Water play an important role in regulation of body temperature and increased survival times for birds (Fox, 1951).

For these reasons water is available *ad libitum* under tropical conditions and the practice of water restriction for broiler breeders in hot climate has not been investigated.

Thus, the objectives of the present study include :

1. To study the effect of water restriction on the performance of broiler breeders.
2. To study the welfare of broiler breeders by using a range of behavioural indices.

CHAPTER II

LITERATURE REVIEW

Broiler Breeders

Broiler breeder birds are fast growers and have the capacity to consume large amount of feed. If allowed to feed *ad libitum*, broiler breeders would weigh at 8 - 9 weeks almost what is required of them at 20 weeks of age (Costa, 1981). Lower body weight with restricted feeding will increase fertility (Bushong, 1980) and reduced mortality (Katanbaf et al., 1989) compared with *ad libitum* feeding. Therefore, energy intake of broiler breeders must be controlled at an earlier age by either quantitative or qualitative feed restriction (Karunajeewa, 1987). The practice of feed restriction will increase water consumption. The recommendation is to limit the water supply to only a few hours a day to prevent overdrinking and to reduce spillage (Appleby et al., 1992).

Water

Water is essential for life, and should be regarded as a major factor in poultry rearing and management. Water makes up from 55 to 75% of the body of chicken, and about 65% in eggs (Nesheim et al., 1979). Water enables poultry to carry on normal body functions. It softened the feed for digestion, helped to eliminate waste products, aid in controlling body temperature and served as a lubricant for joints, muscles, and body tissues (Schaible, 1970).

Water Intake

Many factors are known to influence the water intake of chicken. Differences in breeds and strains, growth rates, sex, feed and temperature could account for some discrepancies in water intake (Gardiner and Hunt, 1984).

Marks and Pesti (1984), Wheeler and James (1950), and Glista and Scott (1949) reported that the amount of water consumed as well as the amount of droppings produced varied almost directly with the percent of protein in the diet. High level of dietary salt may also increase water intake (Darden and Marks, 1985; Ogunji et al., 1983 and Damron and Kelly, 1987). Differences in water intake due to sex has been reported by Marks (1986), in which male broiler chickens drank more than the females. Savory (1986) reported that water intake was higher during high temperature (32^0C) than at moderate temperature (20^0C). At high cyclic temperatures water consumption increased at each age (May and Lott, 1992). Drinking systems also showed

differences in water intake. Lee et al., (1989) reported that daily water intake and moisture content of excreta were higher for trough than nipple drinkers.

The effect of feed restriction on water intake has been investigated. Bennett and Leeson (1989), showed that skip a day fed birds tend to drink more water on feed days than on off feed days. An approximate water consumption figures for broiler breeders throughout the growing period is depicted in Table 1. (Management guide of Arbor Acre broiler breeders).

Water Restriction

Several workers investigated the effect of water restriction on body weight, feed intake, feed conversion, and mortality in broiler chickens (Kellerup et al., 1965; Kese and Awuah 1982 and Gerry, 1980). Water restriction is commonly practiced in laying hens as a method for force molt (Said and Sullivan, 1984; Christmas and Harms, 1983). In broiler breeders, water restriction is practiced to control litter moisture (Savory et al., 1992) and to control growth rate in breeders (Leeson et al., 1988; Ross et al., 1981).

Table 1

Water Consumption Chart Per 100 Birds/Day at 21^0C

Age (weeks)	Liters	Age (weeks)	Liters
1	1.9	11	17.8
2	3.8	12	18.5
3	5.7	13	20.1
4	8.3	14	21.2
5	11.4	15	22.3
6	12.1	16	23.1
7	13.2	17	24.2
8	15.1	18	25.0
9	15.9	19	25.7
10	17.0	20	26.5
		21	27.2

Management guide of Arbor Acre broiler breeders

Effect of Water Restriction on Body Weight

A number of workers studied the effect of water restriction on the body weight for broiler chicken, laying hens and broiler breeders. Abdelsamie and Yadiwilo (1981) and Marks (1980) observed that water restriction caused a significant depression in body weight gain in broilers. On the other hand, Gerry (1980) and Samoilova and Erasova (1995) noted that there was no significant effect on body weight gain. There conflicting results were also observed in broiler breeders. Hocking (1993) reported that body weight was

not significantly higher when the intake of water was limited than when it was freely available. However, Degen et al., (1992) reported that there was no significant difference in body weight for birds provided either restricted or *ad libitum* drinking water.

Effect of Water Restriction on Feed Intake

The effect of water restriction on feed intake in broilers has been substantially studied (Kese and Awuah, 1979; Abdelsamie and Yadiwilo, 1981; Kese and Awuah, 1982; and Ramlah and Azhariyah, 1994). The authors reported that feed intake was reduced with decrement of water intake compared with water available *ad libitum*. In laying hens, Savory (1978) found a positive correlation between food and water intake on a daily basis and that restriction of water to 90% of its *ad libitum* intake caused a reduction in feed intake. Since, broiler parent stocks are subjected to a programme of restricted feeding which is designed to control body weight gain during rearing, water restriction could be used without affecting feed consumption (Hocking, 1993; Bennett and Leeson, 1989). Feed intake was reduced in turkey breeders when water was restricted to 1h per day compared with water available *ad libitum* during production period (Leeson et al., 1988).

Effect of Water Restriction on Egg Production

Findings on the effect of water restriction on egg production in laying hens are conflicting. Egg production was reduced when water was deprived for 24 hour (Adams, 1973; Summers and Leeson, 1976), while Others (Muir and Gerry, 1976; Hill and Richards, 1975; Maxwell and Lyle, 1957) reported

no significant effect of limited water on egg production. Abdul Aziz (1997) reported that insufficient water consumption either by inadequate water space or problems in water system resulted drop in egg production in chickens and turkeys.

Effect of Water Restriction on Egg Weight

Egg size is one of the factors influencing the purchase and consumption by consumers (Africa and Pautz, 1968). Factors affecting egg weight include age, genetics, nutrition and environment (French and Tullett, 1991). According to Bell (1980), egg weight was decreased by approximately 9% when water was not available.

Effect of Water Restriction on Health

The practice of water restriction in adult hens developed symptoms of blue comb disease after 2 - 3 days (Fisher et al., 1961; Bierer et al., 1965). On the other hand, birds showed a signs of hyperthermia when preventing from drinking water during heat stress (Fox, 1951). Meanwhile, litter moisture content was significantly related to the prevalence of coccidiosis by providing a good sporulation oocysts (Jordan, 1990; Perez et al., 1987).

Flock Uniformity

Flock uniformity is defined as the number of birds weighing within a range of plus or minus 10% of the flock average (Cunningham, 1980). The more uniform the flock, the earlier the flock peaks in egg production and flocks with poor flock uniformity do not peak as high as those with good

uniformity (North, 1980). Petitte et al. (1981) reported that flock uniformity can be controlled through segregation of breeder pullets according to body size. Feed quality, temperature, beak trimming, vaccination and handling are factors which may affect body uniformity (Bell, 1995).

Behaviour and Welfare

Animal welfare has been defined as being a state of complete mental and physical health in which the animal is in harmony with its environment (Hughes as cited by Wood Gush, 1983). Swarbrick (1995) defined welfare as the external environment around the animals, many aspects of which can be objectively and easily assessed and measured. In terms of welfare, all systems offer potential advantages and disadvantages. The UK's Farm Animal Welfare Council had proposed that a husbandry system should provide animals with: freedom from hunger and thirst; freedom from thermal and physical discomfort; freedom from pain, injury and disease; freedom from fear and distress; and freedom to exercise most normal patterns of behaviour (Appleby et al., 1992).

One possible methods of using behaviour as an indicator of welfare is to look for abnormal behaviour (Duncan and Dawkins, 1983). Abnormal behaviour is defined as a persistent, undesirable action, shown by a minority of the population which is not due to any obvious neurological lesion and it is not confined to the situation that originally elicited it (Fox, 1968). Under abnormal behaviour there is a category of behaviour called stereotypies (Duncan and Dawkins, 1983). Stereotypies are known as repetitive actions that are fixed in form and orientation and serve no obvious purpose (Dantzer,