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Water as a Source of Minerals: Contribution of Wells Water for Mineral Nutrition in Broilers

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ABSTRACT

Free drinking water as a source for minerals was overlooked when formulating animal diet. No available data on the contribution of wells water to the mineral nutrition of poultry (broilers) had been reported in Jordan. This research was designed to examine minimal and maximal contribution of minerals content in Karak governorate in the relation to minerals requirements in broilers at different growth stages. In this study, maximum concentration of Ca in examined wells water did not provide significant supply to broilers nutrition at different ages (maximum contribution did not exceed 1.4%). However, Na and Cl concentration of different wells water sources provided small to medium contribution to broilers nutrition (the highest contribution of water to daily Na and Cl requirements was 13.0 and 22.1%, respectively). Based on minerals content specification in the current study, it can be concluded from this study that different wells water sources in Jordan can provide small to medium contribution to mineral nutrition in broilers at different growth stages.

Key words: Drinking water, poultry, minerals, growth stage

INTRODUCTION

Water has been reported to be an important source of minerals for ruminants (Manera et al., 2016; Al-Nawaiseh and Al-Rabadi, 2018; Wagner and Engle, 2021) and poultry (Alrabadi *et al.,* 2019; Sheikh, 2019). When present within the acceptable range, minerals are normally found in water in amounts that do not affect animal performance (Elsaidy *et al.,* 2015; Alrabadi *et al.,* 2019). Daily animal requirements from minerals can be obtained from provided feed and drinking water. Variation in mineral content within same type of feed ingredient can make ideal mineral content in complete feed difficult to achieve (Al-Rabadi, 2017a; Al-Dalain *et al.,* 2020) unless mineral analysis for both feed and water is made before formulation complete animal feed. When the levels of certain minerals are out of balance, they can either directly or indirectly impact animal health (El-Mahdy *et al.,* 2016). For example, improper minerals intake in poultry can affect negatively poultry performance (Sheikh, 2019) and dairy cattle welfare (Ahuja and Parmar, 2017; Al-Rabadi and Al-Hijazeen, 2018). Therefore, a well balanced mineral in animal diets is needed to maintain optimal animal health and enhance productivity. Even when mineral analysis for complete diet is measured, minerals content of drinking water is not counted when formulating animal's diets. Therefore, minerals content in complete animal diet should be adjusted in relation to the contribution of minerals in drinking water. In literature, there is no or very little information for the contribution of drinking water from wells to mineral nutrition of poultry. To best of our knowledge, this was the first study that was aimed at evaluating the contribution of drinking water, obtained from wells in Jordan, to mineral nutrition of broilers at different growth stages.

MATERIALS AND METHODS

Minerals (Ca, Na, K and Cl) concentration from the nine drinking wells distributed in Karak governorate/Jordan were measured according to the procedure described by Al-Rabadi (2017 b; Table 1).

RESULTS AND DISCUSSION

Broilers had different minerals requirements at different production stages (Table 2). Daily requirements of minerals increased with age. The contribution of minerals from wells water to broilers nutrition increased with age. In this

Table 1. Cation and anion concentration (mg/l) of wells water obtained from different sources

Well source sample	Na	K	Ca	Cl
1	42.03	1.98	26.97	83.1
2	22.7	1.01	28.00	64.77
3	45.23	1.23	28.10	77.26
4	80.1	2.4	37.03	128.55
5	80.73	2.83	37.47	156.99
6	97.76	1.95	52.33	121.41
7	86.2	73.16	62.93	176.95
8	104.33	4.2	73.46	143.45
9	53.83	0.98	31.86	128.94

Results adapted from Al-Rabadi (2017 b).

study, maximum concentration of Ca in examined wells water did not provide significant supply to broilers nutrition at different ages; maximum contribution did not exceed 1.4%. Wells water provided slightly more K contribution with maximum contribution that did exceed 3.8%. However, Na and Cl concentration of different wells water sources provided small to medium contribution to broilers nutrition. The lowest contribution of wells water to daily Na and Cl requirements was 1.8 and 5.2%, respectively.

Table 2. Estimates of daily feed intake (g/day), water intake (g/day), mineral requirement (g/day) and drinking-water mineral contribution (represented as g/day and as % of daily requirement) for broilers at different production stages

Estimates	Broiler age (week)		
	3	5	7
Feed intake	67	121	168
Water intake	0.104	0.179	0.250
Macro mineral			
Ca requirement	0.67	1.09	1.34
Minimal Ca contribution	0.003 (0.4%)	0.005 (0.4%)	0.007 (0.5%)
Maximum Ca contribution	0.008 (1.1%)	0.013 (1.2%)	0.018 (1.4%)
K requirement	0.2	0.36	0.5
Minimal K contribution	0.0001 (0.05%)	0.0002 (0.05%)	0.0003 (0.05%)
Maximum K contribution	0.008 (3.80%)	0.013 (3.6%)	0.018 (3.7%)
Na requirement	0.13	0.18	0.20
Minimal Na contribution	0.002 (1.8%)	0.004 (2.3%)	0.006 (2.8%)
Maximum Na contribution	0.01 (8.3%)	0.02 (10.4%)	0.03 (13.0%)
Cl requirement	0.13	0.18	0.20
Minimal Cl contribution	0.006 (5.2%)	0.012 (6.4%)	0.016 (8.1%)
Maximum Cl contribution	0.018 (14.2%)	0.032 (17.6 %)	0.044 (22.1%)

On the other hand, the highest contribution of water to daily Na and Cl requirements was 13.0 and 22.1%, respectively. The results of this study showed that minerals contribution (especially for Na and Cl) to broilers nutrition should not be overlooked when formulating poultry diets. These minerals (Na, K and Cl) had been reported to be the most important minerals in evaluating dietary electrolyte balance in poultry diets due to their direct influence on bird's blood buffering capacity, body homeostasis and support optimal production levels especially during heat stress conditions (Chukwuma *et al.*, 2017; Araujo *et al.*, 2022). From nutritional prospective and practical point of view, it was hard to maintain control of the many interactions between minerals and their consequences on to poultry health. For that reason, measuring the variation of mineral concentrations in feed ingredient (including minerals in drinking water sources) would be helpful to recommend mineral-supplementation strategies and give more precise feed formulation to meet requirements in animals especially when feed formulation software was used (Al-Dalain *et al.*, 2020).

CONCLUSION

Based on minerals content in wells water in the current study, different wells water sources in Jordan can provide small to medium contribution to mineral nutrition in broilers at different growth stages and has the potential to reduce feed production cost when minerals in water are incorporated as an ingredient feed formulation.

REFERENCES

Ahuja, A. and Parmar, D. (2017). Role of minerals in reproductive health of dairy cattle: A review. *Int. J. Livestock Res.* **7**: 16-26.

Al-Dalain, S., Al-Rabadi, G., Al-Rawashdeh, M., Al-Nawaiseh, M. Dalaeen, J., Al-Omari, H. Y., Al-Rabadi, S., Al-Nasir, F. and Aldmour, R. (2020). Variation of mineral contents in barley and wheat straws in Karak Governorate: Application in ruminant nutrition. *Ann. Agri. Bio. Res.* **25** : 308-313.

Al-Nawaiseh, M. and Al-Rabadi, G. (2018). Minerals composition of wells water and their contribution to mineral nutrition in dairy cattle: A possible approach in reducing soil

salinity by reducing mineral content in manure. *Ukrainian J. Ecol.* **8**: 71-74.

Al-Rabadi, G. (2017a). Characterization of minerals content in olive cake and bakery wastes: Application in animal nutrition and bio-fuel production. *Ukrainian J. Ecol.* **7**: 192-196.

Al-Rabadi, G. (2017b). Minerals composition of wells water in Karak, Jordan and their relation to tolerance limits in dairy cattle. *J. Livestock Sci.* **8**: 187-190.

Al-Rabadi, G. and Al-Hijazeen, M. (2018). Variation in dietary cation-anion differences (DCAD) of feed ingredients in relation to milk fever disease in dairy cattle. *Ukrainian J. Ecol.* **8**: 51-56.

Alrabadi, N., Al-Rabadi, G. and Alzoubi, K. (2019). Ions composition of waste water after reverse osmosis filtration of drinking water: Risk analysis and contribution to mineral nutrition. *J. Appl. Animal Res.* **47**: 582-585.

Araujo, A. C., Araújo, R. D., Dourado, L. R., Machado, J. S., Bayão, G. F., Amoroso, L., Artoni, S. M., Shimano, A. C. and Silva Sousa, K. R. (2022). Analysis of performance, bone characteristics and expression of genes involved in the balance of ionic concentrations in broilers subjected to dietary electrolyte balance levels. *British Poultry Sci.* **63**: 226-234.

Chukwuma, U. O., Franklin, N. E., Chioma, U. O., Christian, A. C., Mary, N. C. and Charles, O. I. (2017). Dietary electrolyte balance status of commercial poultry feeds sold in the hot humid tropical environment of Owerri. *South-eastern Nigeria* **15**: 1-7.

El-Mahdy, C., Boaru, A., Popescu, S. and Borda, C. (2016). Water quality, essential condition sustaining the health, production, reproduction in cattle–A review. *Bull. Univ. Agric. Sci. Vet. Med. Cluj-Napoca. Animal Sci. Biotech.* **73**: 113-125.

Elsaidy, N., Mohamed, R. A. and Abouelenien, F. (2015). Assessment of variable drinking water sources used in Egypt on broiler health and welfare. *Vet. World* **8**: 855-864.

Manera, D., Voltolini, T., Menezes, D. and Araújo, G. (2016). Chemical composition of drilled wells water for ruminants. *J. Agric. Sci.* **8**: 127-137.

Sheikh, I. U. (2019). Water as a critical nutrient in maintenance of poultry health and its role in production performance. *Int. J. Vet. Sci. Anim. Hus.* **4**: 12-15.

Wagner, J. J. and Engle, T. E., (2021). Invited review: Water consumption and drinking behaviour of beef cattle and effects of water quality. *Appl. Anim. Sci.* **37**: 418-435.