



<b>General information</b>	
PPP-number	<b>TKI-AF-15203</b>
Title	<b>Healthy Bones</b>
Theme	<b>Sustainable animal production</b>
Implementing institute	<b>Wageningen Livestock Research</b>
Project leader research (name + e-mail address)	<b>Dr. ir. Ingrid de Jong, ingrid.dejong@wur.nl</b>
Coordinator (on behalf of private partners)	<b>Ir. A. Dijkslag, ForFarmers</b>
Project-website address	<a href="https://www.wur.nl/nl/project/AF-15203-Healthy-Bones.htm">https://www.wur.nl/nl/project/AF-15203-Healthy-Bones.htm</a>
Start date	<b>1-1-2016</b>
Final date	<b>31-12-2020</b>

<b>Approval by the coordinator of the consortium</b>	
The annual report must be discussed with the coordinator of the consortium. The "TKI's" appreciate additional comments concerning the annual report.	
Assessment of the report by the coordinator on behalf of the consortium:	<input checked="" type="checkbox"/> Approved <input type="checkbox"/> Not approved
Additional comments concerning the annual report:	<p>One remark regarding the achieved results 2019 (1): 'enriched chickens' means chickens housed in an enriched environment.</p> <p>I thank the research team for all the hard work done.</p>

<b>Summary of the project</b>	
Problem definition	Locomotion problems are one of the major welfare issues in broiler chickens. In addition to that, a relatively high proportion of wing fractures or dislocations are observed at the slaughter plant due to catching and handling of the broilers, which not only is a welfare issue, but also leads to economic losses. It is expected that increasing bone strength will improve locomotion of broiler chickens and reduce the risk for fractures and dislocations due to handling and catching of the birds before slaughter. Our hypotheses are that optimal temperature and light schedules during incubation, in combination with optimal nutrient supply to the chickens and improved housing conditions, will increase bone strength.
Project goals	To determine whether or not the quality of leg and wing bones in broiler chickens can be improved by (1) diet composition of the parent stock (breeders), (2) diet composition of the broilers, (3) light regime and incubation temperature and (4) the housing conditions of the broiler chickens.

<b>Results</b>	
Planned results 2019	(1) Study on the effects of environmental enrichment and genetic background of broiler chickens on leg bone quality; (2) Study on the effects of broiler breeder diet composition and genetic background on leg bone quality of the progeny;

	(3) Measuring wing bone and joint characteristics in experiments performed in the past and in 2019.
Achieved results 2019	<p>(1) This study will be repeated in 2020, as unfortunately the correct procedures were not applied at the final slaughter moment of the slower-growing chickens and most chickens were lost at the plant, thus, no bones could be collected from these chickens preventing a fair comparison of bone strength between all treatment combinations. The performance and behaviour data of the experiment in 2019 were analysed and these will be published in a scientific paper. Data analysis showed that the enrichment was well used by the chickens, and was better used by the slower growing than by the fast growing chickens. Enriched chickens were more active than non-enriched chickens of both breeds, and slower-growing broilers were more active than fast-growing ones. Pen enrichment had a negative effect on weight gain and feed conversion rate. Based on these results, it was decided to repeat the experiment with the same treatments in February 2020 and to study the effect on bone strength.</p> <p>(2) An experiment was carried out in which fast and slow growing broiler breeders were fed a diet differing in origin of macro and trace minerals (anorganic vs organic). Measurement were performed on the offspring. First results demonstrated that with the organic minerals, the fertility and hatchability appear to be higher than with the anorganic minerals. Performance of the offspring and bone development is currently part of statistical analyses.</p> <p>(3) Wings of experiment 1 (control diet, fish oil, collagen or organic minerals) fed to broilers, experiment 2 (different incubation temperature profiles) and experiment 5 (broiler breeder experiment, see 2) were used for a stretching test, morphological measurements and breaking test. Data are currently analysed.</p>
Planned results 2020	<p>(1) To determine the effect of environmental enrichment and genetic strain on bone quality in broiler chickens (repetition of experiment carried out in 2019), including a draft publication on the results.</p> <p>(2) To carry out a proof-of-principle experiment in which the most promising treatments to improve bone strength in broiler chickens will be combined, including a draft publication on the results.</p> <p>(3) Data obtained from experiment 3 (incubation light, origin of macro and trace minerals) and experiment 4 (broiler breeder experiment, see above) will be analysed and reported.</p> <p>(4) Data of wings of all experiments will be obtained, analysed and reported.</p>

<p><b>Deliverables/products in 2019</b> (provide the titles and /or a brief description of the products/deliverables or a link to a website.)</p> <p><u>Scientific articles:</u></p> <p>Guz, B., Molenaar, R., de Jong, I. C., Kemp, B., van den Brand, H. &amp; van Krimpen, M. M., 2019. Effects of dietary organic minerals, fish oil, and hydrolyzed collagen on growth performance and tibia characteristics of broiler chickens. Poultry Science. 98, 12, p. 6552–6563.</p> <p>Güz, B.C., R. Molenaar, I.C. de Jong, B. Kemp, M. van Krimpen, and H. van den Brand. 2019. Effects of eggshell temperature pattern during incubation on tibia characteristics of broiler chickens at slaughter age. Poult. Sci. (accepted)</p>
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External reports:

Articles in professional journals/magazines:

Van Krimpen, M.M., Guz, B., Brand, H. van den, De Jong, I.C., Molenaar, R., 2019. Organische mineralen goed voor botkwaliteit. Pluimveehouderij 17 oktober 2019 26-27.

(Poster) presentations at workshops, seminars, or symposia.

Guz, B., Molenaar, R., de Jong, I. C., van Krimpen, M. M. & van den Brand, H., 2019. Effects of green LED light during incubation and dietary mineral variety during rearing on tibia characteristics of broiler chickens at slaughter age, Proceedings of the 17th International Conference on Production Diseases in Farm Animals. Bruckmaier, R. M. & Gross, J. J. (eds.). Bern, Switzerland: University of Bern, p. 193-193

Guz, B., Molenaar, R., de Jong, I. C., van Krimpen, M. M. & van den Brand, H., Eggshell temperature patterns during incubation on tibia characteristics of broiler chickens at slaughter age Trade-offs in science – Keeping the balance: Abstracts of the WIAS Science Day 2019. Wageningen University & Research, p. 18-18

TV/ radio / social media / newspaper:

Remaining deliverables (techniques, devices, methods, etc.):