Studies on the availability of watermelon rind as feedstuffs in the chicken

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論　文　内　容　の　要　旨

Global warming is rising year by year. As a result, poultry performance and mortality are impacted seriously by heat stress. To attenuate them, several attempts have been tested. One of them is the treatment of amino acid administration, and the treatment can play an important role to support thermoregulation in the chicken. Recently, L-citrulline (L-Cit) has been demonstrated to improve thermotolerance in chicks, but synthetic L-Cit is not recommended in poultry diets in Japan. Watermelon rind (WR), agricultural waste, has a high level of L-Cit and is recommended as a natural source of L-Cit. Therefore, the aims of the present study were to exam the availability of WR as feedstuffs including the hypothermic function in chicks.

The chemical composition and L-Cit content of WR dried powder (WRP) were determined, and revealed a variety of components including 19.1% crude protein. L-Cit was the most abundant free amino acid in WRP. The dried WR powder (WRP) mash diet was fed to 3- to 15-day-old chicks. Daily food intake, body weight, and changes in rectal temperature were measured. At the end of the experiment, blood was collected from the chicks to analyze plasma L-Cit and other free amino acids. Chronic supplementation of the WRP mash diet significantly increased compensatory food intake, plasma L-Cit, L-ornithine, and L-tyrosine in chicks, but did not affect the body temperature of the chicks.

To reduce fiber contents in WR, WR extract (WRE) was obtained from WR juice. Chicks at 14-day-old were subjected to acute oral administration of WRE (2 ml) under control thermoneutral temperature (CT: 30 ± 1°C). Acute oral administration of WRE significantly reduced body temperature under CT. Then, 15-day-old chicks were orally administered with 1.6 ml of either WRE, or 7.5 or 15 mmol/10 ml of L-Cit under CT. The degree of lowering of body temperature by WRE was similar to that observed at high L-Cit. Next, after dual oral

administration of (1.6 ml) WRE or L-Cit (15 mmol/10 ml), 15-day-old chicks were exposed to a high ambient temperature (HT: 35 ± 1°C) to monitor the changes in body temperature. Body temperature was significantly low at a HT owing to the oral administration of WRE. However, the lowered body temperature was difficult to explain by the content of L-Cit in WRE alone.

To explain the function of WRE other than L-Cit, chemical composition of WRE was analyzed. WRE contained a high level of phosphorus, which maintains in form of inorganic phosphate anions and organophosphate compounds in plant. Thus, to explain the function of WRE, the effects of pyrophosphoric acid (PPi) and monophosphoric acid (Pi) on body temperature was investigated. PPi (7.5 mmol/10 ml/kg BW) and Pi (15 mmol/10 ml/kg BW) clearly lowered body temperature after administration. It is suggested that a part of the function of WRE here was through phosphates as ingredients of WRE.

In conclusion, WRE, processed from WR juice, is a good feedstuff having body temperature lowering effect in the chicken.