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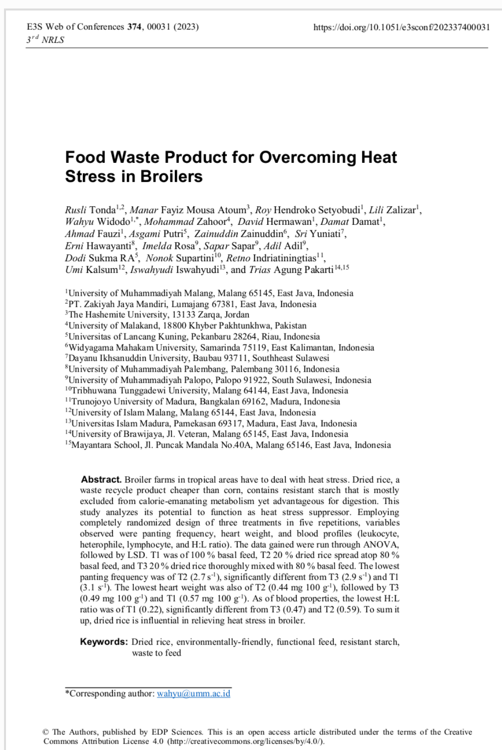

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Food Waste Product for Overcoming Heat Stress in Broilers

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Abstract. Broiler farms in tropical areas have to deal with heat stress. Dried rice, a waste recycle product cheaper than corn, contains resistant starch that is mostly excluded from calorie-emanating metabolism yet advantageous for digestion. This study analyzes its potential to function as heat stress suppressor. Employing completely randomized design of three treatments in five repetitions, variables observed were panting frequency, heart weight, and blood profiles (leukocyte, heterophile, lymphocyte, and H:L ratio). The data gained were run through ANOVA, followed by LSD. T1 was of 100 % basal feed, T2 20 % dried rice spread atop 80 % basal feed, and T3 20 % dried rice thoroughly mixed with 80 % basal feed. The lowest panting frequency was of T2 (2.7 s^{-1}), significantly different from T3 (2.9 s^{-1}) and T1 (3.1 s^{-1}). The lowest heart weight was also of T2 (0.44 mg 100 g^{-1}), followed by T3 (0.49 mg 100 g^{-1}) and T1 (0.57 mg 100 g^{-1}). As of blood properties, the lowest H:L ratio was of T1 (0.22), significantly different from T3 (0.47) and T2 (0.59). To sum it up, dried rice is influential in relieving heat stress in broiler.

Keywords: Dried rice, environmentally-friendly, functional feed, resistant starch, waste to feed

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Artikel 6

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6 # Food Waste Product for Overcoming Heat Stress in Broilers

Rusli Tonda[1,2], *Manar* Fayiz Mousa Atoum[3], *Roy* Hendroko Setyobudi[1], *Lili* Zalizar[1], *Wahyu* Widodo[1,*], *Mohammad* Zahoor[4], *David* Hermawan[1], *Damat* Damat[1], *Ahmad* Fauzi[1], *Asgami* Putri[5], *Zainuddin* Zainuddin[6], *Sri* Yuniati[7], *Erni* Hawayanti[8], *Imelda* Rosa[9], *Sapar* Sapar[9], *Adil* Adil[9], *Dodi* Sukma RA[5], *Nonok* Supartini[10], *Retno* Indriatiningtias[11], *Umi* Kalsum[12], *Iswahyudi* Iswahyudi[13], and *Trias* Agung Pakarti[14,15]

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Keywords: Dried rice, environmentally-friendly, functional feed, resistant starch, waste to feed

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1 Introduction

Other than the constantly rising feed cost, a common problem faced by broiler chicken farmers in tropical areas is the generally high temperature [1, 2]. An increase in environmental temperature often costs them low farming performance [3–5] as heatstroke in broilers triggers sudden death or infectious diseases [6, 7]. When broiler morbidity and mortality rates rise, their productivity drops [8, 2] and negatively affects their income [9, 10]. High temperature instigates heat stress [11, 8], which is defined as a condition when cattle undergoes increasing warmth or other stressors either externally or internally [12, 2]. Responding to heat stress can impair jejunum that will disrupt digestive process when it occurs [13–15], causing a halt to overall metabolism [16, 17]. Feeling uncomfortable, cattle consume less, so fewer nutrients will be absorbed. Low nutrient intake brings about protein deficiency in blood [18, 19], which then reduces the cattle's ability to form antibody [20, 21].

A scheme to prevent digestive problem under the stress is by optimizing apathogen microorganism functions internally [22, 23], as higher quantity and quality of such microorganisms should be able to boost organic acid production, which is key to restore and enhance ileal villi in the jejunum [24, 25]. Attempts to maximize microorganism functions have been made by researchers by employing probiotics and synbiotics to complement ileal villi [26, 27]. Another endeavor made is by administering resistant starch (RS) that is proven effective to improve ileal villi for digestion [28, 29]. At days of high environmental temperatures, RS helps to relieve intestinal activities as it is not easily digested [30, 31]. Further, RS is able to maximally function as microbial nutrients in organic acid forming [30]. A source of RS is carbohydrate that has been through heating and cooling procedures. The RS development process is called gelatinization, and the result is also recognized as retrograded starch [32–34, 31]. One of the feed choices containing RS is dried rice.

4 Dried rice is an organic waste product recycled from expended rice. The fact that organic waste in the form of food remains in Indonesia is as high as 30×10^6 t yr^{-1} [35–37] – of which 276×10^3 t is rice waste [38, 39] – can be detrimental to the environment if left unmanaged [40–43]. Out of three presented recommendations to solve the problem covering biogas production [44–46, 36], compost fertilizer production [47, 48], and feed production [49–51], dried rice is an answer for the third one.

Overall, processing rice waste into dried rice for chicken feed elucidates three problems in one fell swoop: to overcome heat stress in chicken, to offer an alternative feed, and to
4 reduce organic pollutants. This study aims to investigate the potential of dried rice to overcome heat stress and keep broiler chicken healthy.

2 Materials and methods

2 Conducted in the experimental cage of *PT. Zakiyah Jaya Mandiri* in Lumajang, East Java,
2 Indonesia, this research had been consented by the ethical commission of the Faculty of Medicine of University of Muhammadiyah Malang (No. E.5a./2022/KRPK-UMM/X/2022). The hematology test was completed in the Office of Veterinary Research in Wates, Yogyakarta, Indonesia.

2.1 Materials

1 The objects of 200 d old chickens (DOCs) were of platinum class (*PT. Multibreeder Adirama Indonesia, Tbk.*) at an average weight of 42 g. Preliminary maintenance had been ongoing since they were of 1 d old, involving feed of BR1 series (*PT. Wonokoyo*) and battery-powered

cage sized 100 cm × 100 cm × 100 cm per treatment unit. Feed and water were administered *adlibitum*. Treatments began at the age of 21 d.

Dried rice utilized had been tested for nutrient contents in the Nutrition Laboratory of University of Muhammadiyah Malang, East Java, Indonesia with the results of water content 12.58 %, dry matter 87.42 %, ash content 0.83 %, crude protein 8.96 %, crude fat 0.43 %, and crude fiber 0.59 %.

2.2 Methods

Completely randomized design of three treatments in five repetitions – making up to 15 tests – was appointed. 12 healthy broilers of 21 d were selected for each unit, totaling 180. The first treatment (T1) was given 100 % basal feed, the second one (T2) with 20 % dried rice spread on top of 80 % basal feed, and the third one (T3) with 20 % dried rice evenly mixed with 80 % basal feed. Feed was administered on daily basis at the same amount for 35 d. The observation data was tabulated using Microsoft Excel program. Feed formula had been run through Microsoft Excel and is detailed in Table 1.

Table 1. Feed formula in treatments.

No	Ingredient	T1	T2	T3
1	Corn (%)	69.43	48.91	48.91
2	Wheat pollard (%)	5.31	2.66	2.66
3	Corn gluten meal (CGM) (%)	12.60	12.49	12.49
4	Distillers dried grains with solubles (%)	3.00	5.00	5.00
5	"Aking-rice" (%)	0.00	20.00	20.00
6	Meat bone meal (%)	7.23	8.04	8.04
7	Palm oil (%)	0.20	1.00	1.00
8	L-Lysine HCL (%)	0,96	0.88	0.88
9	Calcium carbonate (CaCO3) (%)	0,65	0.58	0.58
10	Salt (%)	0.17	0.21	0.21
11	DL methionine (%)	0.15	0.13	0.13
12	Dicalcium phosphate (%)	0.30	0.10	0.10
	------------------------------------- Calculated analyses ------------------------------------			
13	Poultry ME (kcal kg^{-1})	3 200.00	3 200.00	3 200.00
14	Crude protein (%)	20.00	20.00	20.00
15	Crude fat (%)	4.75	4.75	4.75
16	Crude fiber (%)	3.84	3.84	3.84
17	Calcium (%)	0.90	0.90	0.90
18	Available phosphorus (%)	0.45	0.45	0.45
19	Na (%)	0.15	0.15	0.15
20	Lysine (%)	1.00	1.00	1.00
21	Metionin (%)	0.38	0.38	0.38

2.2.1 *Panting frequency*

Panting is chicken's way to release heat from its body for heat stress relief. To determine panting frequency, counting exhales or chest heaves for 1 min is the procedure [52, 53]. Objects were checked for their panting frequencies at 13:00 at an average environmental temperature of 31 °C with a stopwatch.

2.2.2 Heart weight

Heart distributes blood in the lungs to exchange O_2 and CO_2 in an efficient manner during metabolism [54] as well as other parts of the body, nourishing cells when circulating. To determine heart weight, Equation (1) applies:

$$\text{Heart weight (\%)} = \frac{Heart\ weight\ (g)}{Body\ weight\ (g)} \times 100\ \% \qquad (1)$$

2.2.3 Leukocyte

Leukocyte is a blood component with ability to counter infections due to viruses, bacteria, or toxin metabolic process [55, 56]. For leukocyte test, 5 mL of EDTA or heparin blood of each object was added in a mini tube with 95 HCl 5 %, and then mixed with HCl 5 % by taking and releasing five times using a pipette. 10 mL of the solution was placed in a glass hematocytometer and observed under a microscope with a 10 × objective.

2.2.4 Heterophile and lymphocyte

Hematological parameters were collected from blood smears [57, 58, 7]. Blood samples were taken from the brachial wing vein and stored in 2 mL tubes once all treatments had concluded. Each was smeared on an object glass, fixed with methanol, colored with giemsa, washed with water, and left in room temperature. Microscope observation was done when the smears had dried to find the percentages of existing heterophile and lymphocyte. The proportions were then multiplied by the number of leukocytes in order to obtain the number of heterophiles and lymphocytes.

2.2.5 H:L ratio

H:L ratio is the essential stress indicator in poultry. A healthy chicken should be of between 0.3 and 0.7 [59, 60, 56], and any values below or past the interval are signs of health issue, including heat stress. Dividing the number of heterophiles by the number of lymphocytes results in H:L ratio [61, 52].

2.3 Statistical analysis

The data obtained from panting frequency and heart weight examinations as well as hematology analysis were tabulated in Microsoft Excel and then run through ANOVA [62, 63]. Any significance in treatments called for LSD test [64, 65].

3 Result and discussion

3.1 Physiological review of broiler health

The effect of dried rice towards broiler's physiological conditions in heat is detailed in Table 2.

Table 2. Panting frequency rates and relative heart weights.

Treatment	Panting frequency (s^{-1})	Heart weight (mg 100 g^{-1})
T1	$3.1^{a} \pm 0.09$	$0.57^{a} \pm 0.10$
T2	$2.7^{b} \pm 0.05$	$0.44^{b} \pm 0.05$
T3	$2.9^{c} \pm 0.05$	$0.49^{a} \pm 0.06$

3.1.1 Panting frequency

12 The result shows significant differences among treatments ($P < 0.05$) with the lowest panting frequency belongs to T2 [(2.7 ± 0.05) s^{-1}], followed by T3 [(2.9 ± 0.05) s^{-1}] and T1 [(3.1 ± 0.09) s^{-1}]. The significance is mapped further in Figure 1.

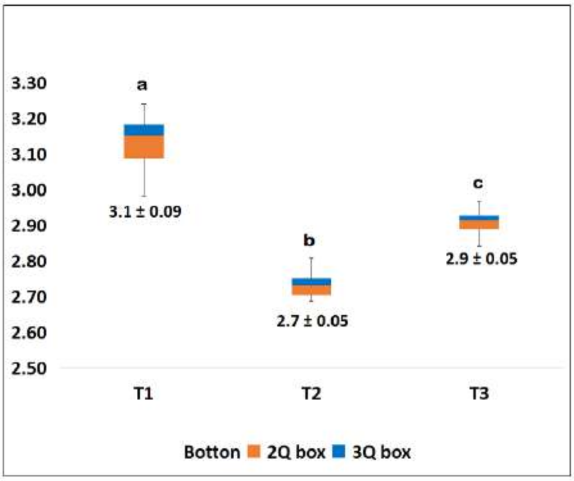

Fig. 1. Panting frequency.

The level of heat stress in broilers is apparent from the panting frequency per minute [66–68] – the more a broiler pants, the higher the heat stress is [69, 70]. High panting frequency implies high calorie discharge [71, 72], which is the chicken's attempt to reduce heat as one has no sudoriferous glands to cool itself down. The heat is a result of both high environmental temperature and the increasing bodily temperature due to metabolism.

The low panting frequency in T2 compared to T1 and T3 is inferred to be the effect of dried rice as it prevents calorie from forming even in heat stress. The RS allows it to head to the colon in spite of the small intestine, avoiding involvement in metabolism that produces heat. Spreading it atop the basal feed guarantees higher intake, thus more effective.

3.1.2 Heart weight

12 Significant differences among treatments ($P < 0.05$) were recorded, with the lowest heart
8 weight rate is of T2 [(0.44 ± 0.050) mg 100 g^{-1}], followed by T3 [(0.49 ± 0.06) mg 100 g^{-1}] and T1 [(0.57 ± 0.10) mg 100 g^{-1}]. The significance is depicted in Figure 2.

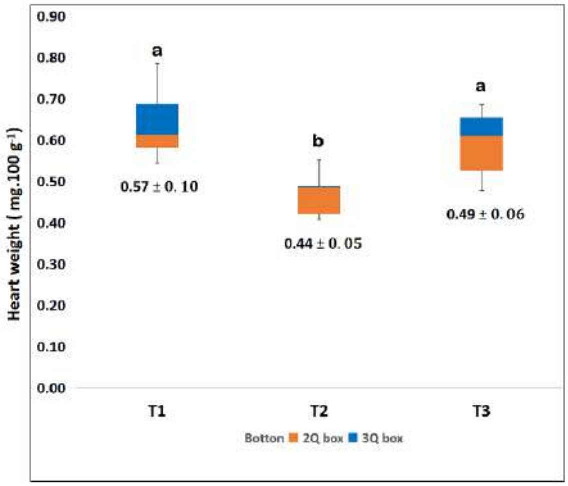

Fig. 2. Heart weight.

A normal heart weighs 0.4 % to 0.70 % [74, 54], and it becomes heavier when conditions like toxin accumulation, pathogenic disturbance, or heat stress strike. The harder the heart works, the larger it will be [75, 54] due to additional heart muscle formation. An increase in heart weight is a physiological response of broiler in high temperature, as the heart is forced to work harder. If the temperature is higher than 35 °C, one exerts itself so hard it can burst at a certain point, which is the cause of sudden death.

The low heart weight rate in T2 compared to T1 and T3 is surmised to be the involvement of dried rice. Mostly spared from metabolism, it does not actively increase the temperature, therefore heart enlargement unlikely occurs. Furthermore, its direct move to the colon makes it beneficial nutrient source for apathogen bacteria there. When apathogen bacteria grow well owing to nutrients in dried rice, there will only be little space for pathogen ones to live in [76, 25].

3.2 Hematological review of broiler health

How dried rice affects broiler's hematological conditions in heat is detailed in Table 3.

Table 3. Rates of leukocyte, heterophile, and lymphocyte in broiler.

Treatment	Leukocyte (10^3 mm^{-3})	Heterophile (%)	Lymphocyte (%)	H:L
T1	$39.24^a \pm 2.98$	$17.60^b \pm 6.656$	$81.20^b \pm 6.058$	$0.22^b \pm 0.096$
T2	$31.28^b \pm 2.92$	$36.00^a \pm 6.042$	$62.40^a \pm 6.504$	$0.59^a \pm 0.152$
T3	$25.48^c \pm 5.83$	$30.20^a \pm 10.257$	$68.00^a \pm 9.670$	$0.47^a \pm 0.214$

3.2.1 Leukocyte

15 Table 3 confirms significant differences among treatments ($P < 0.05$), with the highest number of leukocytes is found in T1 [(39.24 ± 2.981) 10^3 mm^{-3}], followed by T2 [(31.28 ± 2.921) 10^3 mm^{-3}] and T3 (25.48 ± 5.83) 10^3 mm^{-3}] . The significance is presented in Figure 3.

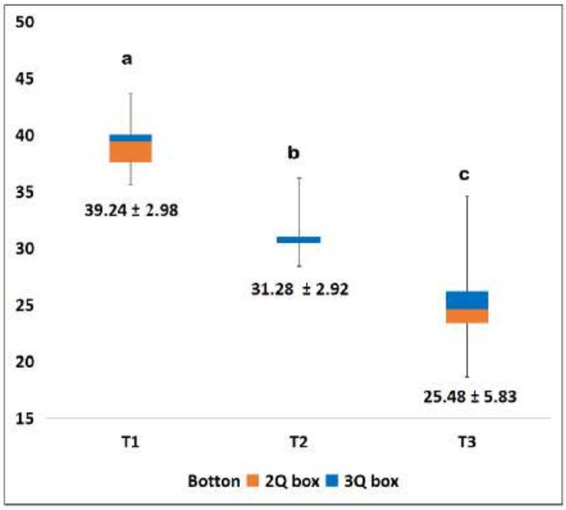

Fig. 3. Leukocytes.

The number of leukocytes is a parameter in examining immunity [79, 80], and the it is typically between 16×10^3 mm^{-3} and 40×10^3 mm^{-3} in a broiler [77, 78]. Despite the disparity, all treatments are considered normal, with T1 at the closest benchmark. The high leukocyte rate in T1 is a physiological response to improve immunity due to heat stress. The increase in leukocyte number does not always mean advanced immunology, as it can represent a bad one. Abnormal quantity of leukocytes indicates depriving immunity. Poor nutrient content in feed, bacterial or viral infections, and intensive free radicals from heat stress are affective toward it [60, 80].

Leukocyte rate in T1 is high, which suggests a challenge to immunity. dried rice in the other treatments apparently helps to ease heat stress, resulting in unelevated leukocyte activities. Supplying nutrients for apathogen microorganism improvement in both quantity and quality, it allows them to constantly produce organic acid for duodenal, ileal villi, and pancreas optimizing. That way, immunity and digestion should be well maintained.

3.2.2 Heterophile

With the highest heterophile rate in T2 [(11.22 ± 1.79) 10^3 mm^{-3}], followed by T3 [(7.90 ± 3.58) 10^3 mm^{-3}] and T1 [(6.98 ± 2.90) 10^3 mm^{-3}] , significant difference ($P < 0.05$) transpires. The result of LSD test is stated in Figure 4.

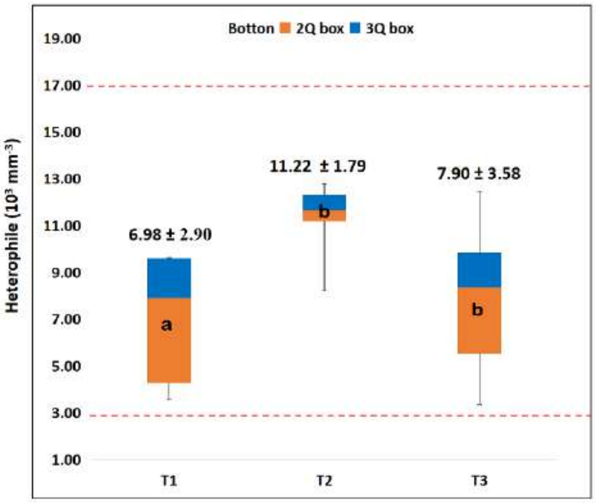

Fig. 4. Heterophile.

Serving as the front line of defense against diseases [56, 78], high percentage of heterophyles indicates good immunity [60, 78]. High temperature lowers the number of heterophyles in leukocytes [81]. While T2 and T3 do not affect the heterophile rates, they are higher than in T1. Dried rice is conclusively operational in increasing heterophile number and, in time, suppressing stress level.

3.2.3 Lymphocyte

The highest lymphocyte rate is in T1 [(31.65 ± 2.75) 10^3 mm^{-3}], followed by T2 [(19.57 ± 3.15) 10^3 mm^{-3}] and T3 [(17.11 ± 3.43) 10^3 mm^{-3}] as listed in Table 3. With existing significant differences ($P < 0.05$), further test came out with results shown in Figure 5.

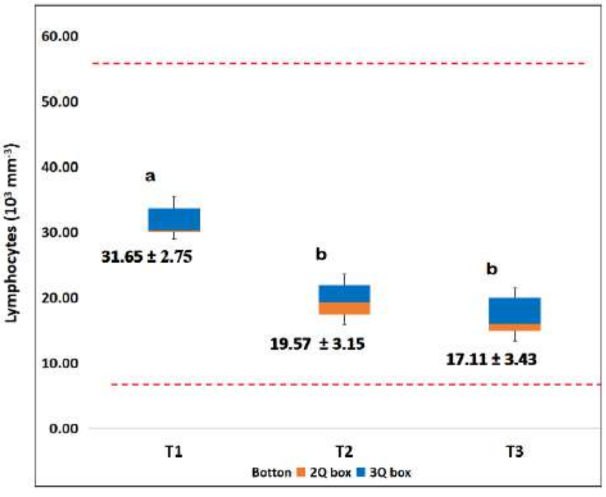

Fig. 5. Lymphocytes.

A high lymphocyte rate implies disruption in broiler's immunity system [82, 61]. While T2 and T3 are of similar numbers of lymphocytes, they are clearly lower than in T1. It is certain that dried rice has a role in minimizing internal disturbance in broilers.

3.2.4 H:L ratio

21 Table 3 reveals the highest H:L ratio is achieved by T2 (0.59 ± 0.15), followed by T3 (0.47 ± 0.21) and T1 (0.22 ± 0.10), with significant differences among treatments ($P < 0.05$) exhibited in Figure 6.

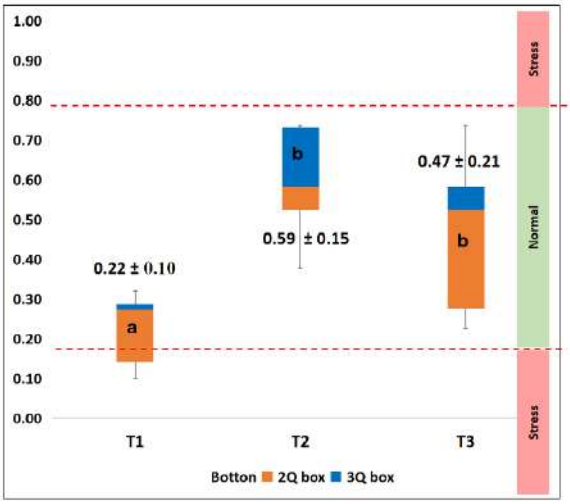

Fig. 6. Heterophile: lymphocyte ratio.

An indicator of stress levels in broilers [83, 84, 58, 61], H:L ratio of a healthy chicken should be of 0.2 to 0.8 [78, 58] – when it drops to ≤ 0.2 or rises to ≥ 0.8, the broiler is in an abnormal condition [59, 60, 78]. Other studies state that the limits are of 0.3 at the lowest and 0.6 at the highest [85, 27, 78], meaning that abnormality is represented by ratios < 0.3 or > 0.6 [59–61]. According to the first, the H:L of T1 is in the lowest ratio or normal, while referring to the latter, it is abnormal. It is therefore definite that dried rice supports broiler's health stability by reducing heat stress.

Featuring RS [88, 30], only a portion of dried rice is digested in the small intestine to generate energy while the rest goes to the colon and aid organic fermentation there [86, 87], maximizing the performance of pancreas by boosting organic acid production [89, 29, 88]. A fit pancreas is able to formulate more insulin for a better metabolism [90, 31]. Furthermore, it nurtures microbes that decompose food remains in the colon to work amiably, allowing them to suppress the ammonia content in the feces [92, 31] and minimize chance of disease from spreading. Pathogenic bacteria are unable to use RS [93, 31], so there is even lower opening to microbial imbalance in digestion.

4 Conclusion and recommendation

It is conclusive that dried rice administration as functional feed in high environmental temperature of > 30 °C is effective in overcoming heat stress in broilers. RS content makes it inconsequential in rising bodily temperature through metabolism. It even facilitates the improvement of digestive system – which often suffers when a broiler gets stressed – by assisting apathogenic microorganism multiplication and fortification to optimize pancreas functioning while suppressing the growth of pathogenic ones.

A household waste recycle product, dried rice is relatively cheap and easy to obtain. Its use as an alternative feed in tropical areas is recommended in order to maintain farming performance and, ultimately, reduce organic pollutant for better environment.

Reference

1. R.R. Santos, A. Awati, P.J. Roubos-van den Hil, T.A.T.G. van Kempen, M.H.G. Tersteeg-Zijderveld, P.A. Koolmees, et al., Avian Pathol., **48**,6**:** 582–601 (2019). https://doi.org/10.1080/03079457.2019.1648750
2. L.J. Lara, M.H. Rostagno, Animals, **3**,2: 356–369 (2013). https://doi.org/10.3390/ani3020356
3. H. Tanizawa, J.I. Shiraishi, S.I. Kawakami, M. Tsudzuki, T. Bungo, J. Poult. Sci., **51**,1**:** 80–86 (2014). https://doi.org/10.2141/jpsa.0130040
4. H. Lin, H.C. Jiao, K. J. Buyse, E. Decuypere, Worlds Poult. Sci. J., **62**,1**:** 71–86 (2006). https://doi.org/10.1079/WPS200585
5. W. Widodo, I.D. Rahayu, A. Sutanto, A.D. Anggraini, H. Sahara, S. Safitri, et al., Sarhad J. Agric., **37**, Special Issue 1**:** 41–47 (2021). https://dx.doi.org/10.17582/journal.sja/2021/37.s1.41.47
6. M.F.W. te Pas, R. Borg, N.J.H. Buddiger, B.J. Wood, J.M.J. Rebel, M.M. van Krimpen, et al., J. Anim. Physiol. Anim. Nutr., **104**,6: 1819–1834 (2020). https://doi.org/10.1111/jpn.13407
7. S. Chegini, A. Kiani, B.P. Kavan, H. Rokni, Ital. J. Anim. Sci., **18**,1: 868–876 (2019). https://doi.org/10.1080/1828051X.2018.1483750
8. A. Ranjan, R. Sinha, I. Devi, A. Rahim, S. Tiwari, Int. J. Curr. Microbiol. Appl. Sci., **8**,2: 1548–1555 (2019). https://doi.org/10.20546/ijcmas.2019.802.181
9. Rusli. Analisis Keberhasilan Peternak Ayam Potong (Studi Kasus Peternak Pola Kemitraan Telur Intan Group di Malang). [Success Analysis of Chicken Farmers (Case Study of Telur Intan Group Breeders Partnership Pattern in Malang)] [Thesis] University of Muhammadiyah Malang, Malang, East Java, Indonesia (2012). [in Bahasa Indonesia]. p.97.
10. M. Li, J. Wu, Z. Chen. Braz, J. Poult. Sci., **17**,4: 559–566 (2015). http://dx.doi.org/10.1590/1516-635x1704559-566
11. M.H. Tamzil, Wartazoa. **24**,2: 57–66 (2014). [in Bahasa Indonesia] http://dx.doi.org/10.14334/wartazoa.v24i2.1049
12. L. Liu, M. Ren, K. Ren, Y. Jin, M. Yan, Poult. Sci., **99**, 11: 6205–6211 (2020). https://doi.org/10.1016/j.psj.2020.08.019
13. D. Shi, L. Bai, Q. Qu, S. Zhou, M. Yang, S. Guo, et al., Poult. Sci., **98**,6: 2405–2413 (2019). http://dx.doi.org/10.3382/ps/pez026
14. P. Lian, S. Braber, J. Garssen, H.J. Wichers, G. Folkerts, J. Fink-Gremmels, et al., Nutrients, **12**,3: 1–31 (2020). https://doi.org/10.3390/nu12030734
15. S.H. Siddiqui, D. Kang, J. Park, M. Khan, K. Shim, Sci. Rep., **10**: 18872 (2020). https://doi.org/10.1038/s41598-020-75885-x
16. E.R. Jordan, J. Dairy Sci., **86**,(E. Suppl.): E104-E114 (2003). https://doi.org/10.3168/jds.S0022-0302(03)74043-0
17. M. Kikusato, G. Xue, A. Pastor, T.A. Niewold, M. Toyomizu, Poult. Sci., **100**,2**:** 957–963 (2021). https://doi.org/10.1016/j.psj.2020.11.050
18. T.W. Tabler, E.S. Greene, S.K. Orlowski, J.Z. Hiltz, N.B. Anthony, S. Dridi, Front. Vet. Sci., 7**, 249**: 1–12 (2020). https://doi.org/10.3389/fvets.2020.00249

19. F. Hu, X. Gao, R. She, J. Chen, J. Mao, P. Xiao, et al.,. Poult. Sci., **96**,4**:** 798–806 (2017). https://doi.org/10.3382/ps/pew379
20. A. De Cesare, I.F. do Valle, C. Sala, F. Sirri, A. Astolfi, G. Castellani, et al., Poult. Sci., **98**,9**:** 3963–3976 (2019). https://doi.org/10.3382/ps/pez132
21. R. Hirakawa, S. Nurjanah, K. Furukawa, A. Murai, M. Kikusato, T. Nochi, et al., Front. Vet. Sci., **7**, 46**:** 1–13 (2020). https://doi.org/10.3389/fvets.2020.00046
22. A.M. Humam, T.C. Loh, H.L. Foo, A.A. Samsudin, N.M. Mustapha, I. Zulkifli, et al., Animals, **9**,644**:** 1–20 (2019). https://doi.org/10.3390/ani9090644
23. S. Sugiharto, T. Yudiarti, I. Isroli, E. Widiastuti, F.D. Putra, Arch. Anim. Breed., **60**,3**:** 347–356 (2017). https://doi.org/10.5194/aab-60-347-2017
24. C. Zhang, X.H. Zhao, L. Yang, X.Y. Chen, R.S. Jiang, S.H. Jin, et al., Poult. Sci., **96**,12**:** 4325–4332 (2017). http://dx.doi.org/10.3382/ps/pex266
25. M.E.A. El-Hack, M.T. El-Saadony, M.E. Shafi, S.Y.A. Qattan, G.E. Batiha, A.F. Khafaga, et al., J. Anim. Physiol. Anim. Nutr., **104**,6**:** 1835–1850 (2020). http://dx.doi.org/10.1111/jpn.13454
26. H. Al-Khalaifa, A. Al-Nasser, T. Al-Surayee, S. Al-Kandari, N. Al-Enzi, T. Al-Sharrah, et al., Poult. Sci., **98**, 10: 4465–4479 (2019). http://dx.doi.org/10.3382/ps/pez282
27. A.A. Mohammed, S. Jiang, J.A. Jacobs, H.W. Cheng, Poult. Sci., **98**,10**:** 4408–4415 (2019). https://doi.org/10.3382/ps/pez246
28. A. Bojarczuk, S. Skąpska, A.M. Khaneghah, K. Marszałek, J. Funct. Foods., **93**, 10509**:** 1–11 (2022). https://doi.org/10.1016/j.jff.2022.105094
29. K. Lotfi, A. Mahdavi, A.J. Javan, H. Staji, B. Darabighane, Iran. J. Appl. Anim. Sci., **9**,2**:** 315–322 (2019). https://www.researchgate.net/publication/329164188_Effects_of_Different_Levels_of_Resistant_Starch_on_Growth_Performance_and_Ileum_Morphology_in_Broilers_a_Comparison_to_Fructooligosaccharide_and_Zinc_bacitracin
30. E. Fuentes-Zaragoza, E. Sánchez-Zapata, E. Sendra, E. Sayas, C. Navarro, J. Fernández-Lõpez, et al., Starch/Staerke, **63**,7**:** 406–415 (2011). https://doi.org/10.1002/star.201000099
31. R. Tonda, L. Zalizar, W. Widodo, R.H. Setyobudi, D. Hermawan, D. Damat, et al., Jordan J. Biol. Sci., **15**,5: 879–886 (2022). https://doi.org/10.54319/jjbs/150517
32. D. Damat, R.H. Setyobudi, J. Burlakovs, Z. Vincēviča-Gaile, D.D. Siskawardani, R. Anggriani, et al., Sarhad J. Agric., **37**,Special Issue 1**:** 159–170 (2021). https://doi.org/10.17582/journal.sja/2021.37.s1.159.170
33. D. Damat, R.H. Setyobudi, P. Soni, A. Tain, H. Handjani, U. Chasanah, Cienc. e Agrotecnologia, **44**: e014820 (2020). https://doi.org/10.1590/1413-7054202044014820
34. D. Damat, R.H. Setyobudi, J.S. Utomo, Z. Vincēviča-Gaile, A. Tain, D.D. Siskawardani, Jordan J. Biol. Sci., **14**,3**:** 389–393 (2021). https://doi.org/10.54319/jjbs/140302
35. A. Setiawan. *Membenahi Tata Kelola Sampah* [Online] from https://indonesia.go.id/kategori/indonesia-dalam-angka/2533/membenahi-tata-kelola-sampah-nasional (2021). [in Bahasa Indonesia]
36. R.H. Setyobudi, E. Yandri, M.F.M. Atoum, S.M. Nur, I. Zekker, R. Idroes, et.al., Jordan J. Biol. Sci., **14**,3**:** 613–620 (2021). https://doi.org/10.54319/jjbs/140331
37. SISPN. Ministry of Environment and Forestry [Online] from https://sipsn.menlhk.go.id/sipsn/ (2022). [in Bahasa Indonesia]
38. A.A.N. Hidayat. *Bappenas: Tanpa Intervensi Kebijakan, Sampah Makanan 112 Juta Ton Per Tahun* [Online] from https://bisnis.tempo.co/read/1470633/bappenas-tanpaintervensi-kebijakan-sampah-makanan-112-juta-ton-per-tahun (2021). [in Bahasa Indonesia]

39. D. Anriany, D. Martianto, Jurnal Gizi dan Pangan, **8**,1**:** 33–38 (2013). [in Bahasa Indonesia]. https://doi.org/10.25182/jgp.2013.8.1.33-38
40. N. Ferronato, V. Torretta, Int. J. Environ. Res. Public Health, **16**,6**:** 1–28 (2019). https://doi.org/10.3390/ijerph16061060
41. G.T. Frumin, M.E. Ivanov, L.A. Kulikova, A.V. Eremina, Proc. Estonian Acad. Sci., **66**, 1: 29–33 (2017). https://doi.org/10.3176/proc.2017.1.07
42. O. Roots, T. Lukki, Proc. Estonian Acad. Sci., **65**,3**:** 304–316 (2016). https://doi.org/10.3176/proc.2016.3.10
43. L. Pajusalu, G. Martin, A. Põllumäe, T. Paalme, Proc. Estonian Acad. Sci., **62**,2: 148–154 (2013). https://doi.org/10.3176/proc.2013.2.09
44. R. Hendroko, T. Liwang, S. Salafudin, P.G. Adinurani, L.O. Nelwan, Y. Sakri, et al., Energy Procedia, **32**: 47–54 (2013). http://dx.doi.org/10.1016/j.egypro.2013.05.007
45. R.H. Setyobudi, A. Wahyudi, S.K. Wahono, P.G. Adinurani, S. Salundik, T Liwang . Int. J. Technol., **4**,3: 202–208 (2013) https://doi.org/10.14716/ijtech.v4i3.115
46. R.H. Setyobudi, S.K. Wahono, P.G. Adinurani, A. Wahyudi, W. Widodo, M. Mel, et al. Matec Web of Conf. **164** (01039):1–13(2018). https://doi.org/10.1051/matecconf/201816401039
47. L.S.B.L. Oliveira, D.S.B.L. Oliveira, B.S. Bezerra, B.S. Pereira, R.A.G. Battistelle, J. Clean. Prod., **155**: 229–237 (2017). https://doi.org/10.1016/j.jclepro.2016.08.093
48. S. Karnchanawong, S. Nissaikla, Int. J. Recycl. Org. Waste Agric., **3**: 113–119 (2014). https://doi.org/10.1007/s40093-014-0072-0
49. L. Truong, D. Morash, Y. Liu, A. King, Int. J. Recycl. Org. Waste Agric., **8**: 417–429 (2019). https://doi.org/10.1007/s40093-019-0276-4
50. L. Pinotti, A. Luciano, M. Ottoboni, M. Manoni, L. Ferrari, D. Marchis, et al., J. Clean. Prod., **294**: 126290 (2021). https://doi.org/10.1016/j.jclepro.2021.126290
51. B. Kierończyk, J. Sypniewski, M. Rawski, W. Czekała, S. Świątkiewicz, D. Józefiak, Ann. Anim. Sci., **20**,1: 157–177 (2020). https://doi.org/10.2478/aoas-2019-0066
52. S. Kang, D.H. Kim, S. Lee, T. Lee, K.W. Lee, H.H. Chang, et al., Front. Vet. Sci., **7**: 568093 (2020). https://doi.org/10.3389/fvets.2020.568093
53. I.C. Nurmawan, T.A. Sarjana, H.I. Wahyuni. *Pengaruh Jarak Trasportasi Terhadap Respon Fisiologis Ayam Broiler*. Prosiding Seminar Teknologi dan Agribisnis Peternakan V, (Purwokerto, Indonesia 2017) Animal Production **5**: 148–153 (2018). [in Bahasa Indonesia]. http://jnp.fapet.unsoed.ac.id/index.php/psv/article/view/34/29
54. A.D. Aqsa, K. Kiramang, M.N. Hidayat, Jurnal Ilmu dan Industri Perternakan, **3**,1: 148–159 (2016). [in Bahasa Indonesia]. https://journal.uin-alauddin.ac.id/index.php/jiip/article/view/3925/3579
55. M.K. Türkyilmaz. Turkish J. Vet. Anim. Sci., **32**,1: 31–36 (2008). https://journals.tubitak.gov.tr/veterinary/vol32/iss1/6
56. I.W.D.W. Hendrawan, I.M. Merdana, and I.W. Sudira, Indonesia Medicus Veterinus. **8**,4: 464–473 (2019). [in Bahasa Indonesia] https://doi.org/10.19087/imv.2019.8.4.464
57. H.W. Cheng, S.D. Eicher, Y. Chen, P. Singleton, W.M. Muir, Poult. Sci. **80**,8: 1079–1086 (2001). https://doi.org/10.1093/ps/80.8.1079
58. S. Sugito, M. Delima, J. Ked. Hewan, **3**,1: 218–226 (2009). [in Bahasa Indonesia] https://doi.org/10.21157/j.ked.hewan.v3i1.3082
59. F. Apriliyani, N. Suthama, H.I. Wahyuni, Animal Agriculture Journal, **2**, 1: 393–399 (2013). [in Bahasa Indonesia] http://ejournal-s1.undip.ac.id/index.php/aaj
60. E. Kusnadi, Media Peternakan. **32**,2: 81–87 (2009). [in Bahasa Indonesia] http://repository.ipb.ac.id/handle/123456789/43207
61. A. Mohammed, M. Mahmoud, R. Murugesan, H.W, Animals, **11**,2: 1–15 (2021). https://doi.org/10.3390/ani11020427

62. P.G. Adinurani. *Design and analysis of agrotrial data: Manual and SPSS.* Plantaxia, Yogyakarta, Indonesia (2016). p.232.
63. A. Wahyudi, S. Sujono, L. Hendraningsih, A. Prima, Z. Vincēviča-Gaile, I. Zekker, *Sarhad J. Agric.,* **37**,Special Issue 1: 84–89 (2021). https://doi.org/10.17582/journal.sja/2021/37.s1.84.89
64. I.E. Malia, Y. Yusuf, IConARD, **232**,03007: 1–11 (2021). https://doi.org/10.1051/e3sconf/202123203007
65. Z. Li, C. Li, Y. Gao, W. Ma, Y. Zheng, Y. Niu, et al., Biomass and Bioenergy, **111**: 39–45 (2018). https://doi.org/10.1016/j.biombioe.2018.01.017
66. H. Lin, H.C Jiao, J. Buyse, E. Decuypere, Worlds Poult. Sci. J., **62**,1: 71–86 (2006). https://doi.org/10.1079/WPS200585
67. M.F. Fijana, E. Suprijatna, U. Atmomarsono, Animal Agriculture Journal, **1**,1: 697–710 (2012). [in Bahasa Indonesi] http://ejournal-s1.undip.ac.id/index.php/aaj
68. N. Dayyani, H. Bakhtiari, Int. J. Adv. Biol. Biomed. Res., **1**,11: 1409–1413 (2013) https://doi.org/10.33945/SAMI/IJABBR
69. G. Zaboli, X. Huang, X. Feng, D.U. Ahn, Poult. Sci., **98**,3: 1551–1556 (2019). http://dx.doi.org/10.3382/ps/pey399
70. A. Yousaf, A. Jabbar, N. Rajput, A. Memon, R. Shahnawaz, N. Mukhtar, et al., World Vet. J., **9**,1: 26–30 (2019). https://doi.org/10.36380/SCIL.2019.WVJ4
71. W. Bessei, World's Poult. Sci. J., **62**, 3: 455–466 (2006). https://doi.org/10.1079/WPS2005108
72. M. Shakeri, E. Oskoueian, H.H. Le, M. Shakeri, Vet. Sci., **7**,2: 1–9 (2020). https://doi.org/10.3390/VETSCI7020071
73. E. Fuentes-Zaragoza, M.J. Riquelme-Navarrete, E. Sánchez-Zapata, J.A. Pérez-Álvarez, Food Res. Int., **43**,4: 931–942 (2010). https://doi.org/10.1016/j.foodres.2010.02.004
74. F.S. Nastain, B.P. Mahardhika, M. Ridla, R. Mutia, IOP Conf. Series**:** Earth and Environ, **788**,012032**:** 1–7 (2021). https://doi.org/10.1088/1755-1315/788/1/012032
75. R.B.B. Ginting, I.K. Berata, I.K. Sumadi, N.L.E. Setiasih, I.N. Sulabda, Indonesia Medicus Veterinus, **10**,5: 690–700 (2021). [in Bahasa Indonesia]. https://doi.org/10.19087/imv.2021.10.5.690
76. Y. Sapsuha, E. Suprijatna, S. Kismiati, S. Sugiharto, Livest. Res. Rural. Dev., **33**,4 **(**2021). http://www.lrrd.org/lrrd33/4/3349yus_ar.html
77. S. Sufiriyanto, N. Iriyanti, E. Susanti, Anim. Prod., **20**,3: 183–190 (2018). https://doi.org/10.20884/1.jap.2018.20.3.732
78. P. Sunu, D. Sunarti, L.D. Mahfudz, V.D. Yunianto, J. Saudi Soc. Agric. Sci., **20**,2: 103–110 (2021). https://doi.org/10.1016/j.jssas.2020.12.005
79. Y. Xu, X. Lai, Z. Li, X. Zhang, Q. Luo, Poult. Sci. **97**,11: 4073–4082 (2018). http://dx.doi.org/10.3382/ps/pey256
80. S. Hidanah, E.K. Sabdoningrum, R.S. Wahjuni, S. Chusniati, Vet. World, **11**,6: 834–839 (2018). https://doi.org/10.14202/vetworld.2018.834-839
81. R.U. Khan, S. Naz, H. Ullah, Q. Ullah, V. Laudadio, Q. Qudratullah, et al., Anim. Biotechnol, **1**: 1–12 (2021). https://doi.org/10.1080/10495398.2021.1972005
82. E. Kusnadi, F. Rahim. Media Peternakan. **32**,3: 155–162 (2009). [in Bahasa Indonesia] https://journal.ipb.ac.id/index.php/mediapeternakan/article/view/1125/330
83. S.L. Weimer, R.F. Wideman, C.G. Scanes, A. Mauromoustakos, K.D. Christensen, Y. Vizzier-thaxton. Poult. Sci., **97**,10: 3381–3389 (2018). http://dx.doi.org/10.3382/ps/pey204
84. A.A. Hassan, R.A. Asim. Iraqi J. Vet. Sci., **34**,2: 357–363 (2020). https://doi.org/10.33899/ijvs.2019.125950.1195

85. N.D. Hoan, T.H. Dung, P.D. Hoan, T.V. Thang. Livest. Res. Rural Dev., **33**,1 **(**2021)**.** http://www.lrrd.org/lrrd33/1/ndhon3316.html
86. Y.G. Curbelo, R.B. Salabarría, B.R. Sanchez, N.A. Dorta, A.A. González, M.H. Villafranca, et al., Livest. Res. Rural Dev., **32**,8 **(**2020). http://www.lrrd.org/lrrd32/8/yanelys32122.html
87. N.H. Arshad, S.A. Zaman, M.H. Rawi, and S.R. Sarbini, Int. Food Res. J., **25**,3: 951–957 (2018). http://www.ifrj.upm.edu.my/25%20(03)%202018/(10).pdf
88. L. Shen, J. Li, Y. Li, Plant Commun., **3**,3: 1–18 (2022). https://doi.org/10.1016/j.xplc.2022.100329
89. A.N.F. Suloi, Jurnal Penelitian dan Pengembangan Agrokompleks, **2**,1**:** 92–96 (2019). [in Bahasa Indonesia]. https://journal.unhas.ac.id/index.php/jppa/article/view/6538
90. E. Banjarnahor, S. Wangko, Jurnal Biomedik, **4**,3: 156–162 (2012). [in Bahasa Indonesia]. https://doi.org/10.35790/jbm.4.3.2012.795
91. B. Sulistiyanto, S. Kismiati, C.S. Utama, Jurnal Veteriner, **20**,3: 352–359 (2019). [in Bahasa Indonesia]. https://doi.org/10.19087/jveteriner.2019.20.3.352
92. Z.F. Rozali, E.Y. Purwani, D. Iskandriati, N.S. Palupi, M.T. Suhartono. Pangan, **27**,3: 215–224 (2018). [in Bahasa Indonesia] https://doi.org/10.33964/jp.v27i3.396
93. R.H.B. Setiarto, B.S.L. Jenie, D.N. Faridah, I. Saskiawan. Jurnal Ilmu Pertanian Indonesia, **20**,3: 191–200 (2015). [in Bahasa Indonesia] https://doi.org/10.18343/jipi.20.3.191