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Research Reports

Quail Carcass Performance Using Additional Feed Combination of Noni Leaf Flour and Black Cumin Flour

Performa Karkas Burung Puyuh dengan Pemberian Pakan Tambahan Kombinasi Tepung Daun Mengkudu dan Tepung Jintan Hitam

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ABSTRACT

Background: Digestive disorders can attack quail and will have an impact on reducing their productivity, such as live weight, abdominal fat weight, and decreased carcass performance. **Purpose:** Providing additional feed from herbal plants in the form of noni flour and black cumin flour can overcome digestive system problems because they contain active substances that are useful as feed supplements, anti-inflammatory, anti-bacterial and others for the livestock's body. **Method:** The research design was a completely randomized design (CRD) with 4 treatments and 4 replications, each replication consisting of 6 quail. Feed treatments were P0: commercial feed (control), P1 = commercial feed + 1% black cumin flour + 3% noni leaf meal, P2 = commercial feed + 2% black cumin flour + 2% noni leaf meal, P3 = commercial feed + black cumin flour 3% + noni leaf flour 1%. The data was then analyzed using analysis of variance (ANOVA). **Results:** The results showed that the treatment given had a significant effect on the percentage of quail carcass weight. The P3 treatment was significantly higher than the other treatments, whereas the P2 treatment was the lowest compared to the other treatments, while the P0 and P1 treatments were not significantly different. Other parameters did not have a significant effect on the percentage of quail abdominal fat, pH, percentage of water holding capacity, and percentage of cooking loss of quail meat. **Conclusion:** In conclusion, the treatment had a significant effect on the percentage of quail carcass weight, while it had no significant effect on the percentage of quail abdominal fat, pH, percentage of water holding capacity, and percentage of cooking loss of quail meat.

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ABSTRAK

Latar Belakang: Gangguan pencernaan dapat menyerang ternak puyuh dan akan berdampak pada penurunan produktivitasnya, seperti bobot hidup, bobot lemak abdomen, dan penurunan performa karkas. **Tujuan:** Pemberian pakan tambahan dari tanaman herbal berupa tepung mengkudu dan tepung jintan hitam dapat mengatasi masalah sistem pencernaan karena mengandung zat aktif yang bermanfaat sebagai suplemen pakan, antiinflamasi, anti bakteri dan lain-lain bagi tubuh ternak. **Metode:** Rancangan penelitian yang digunakan adalah rancangan acak lengkap (RAL) dengan 4 perlakuan dan 4 kali ulangan, setiap ulangan terdiri dari 6 ekor puyuh. Perlakuan pakan yang diberikan adalah P0: pakan komersial (kontrol), P1 = pakan komersial + tepung jintan hitam 1% + tepung daun mengkudu 3%, P2 = pakan komersial + tepung jintan hitam 2% + tepung daun mengkudu 2%, P3 = pakan komersial + tepung jintan hitam 3% + tepung daun mengkudu 1%. Data yang diperoleh kemudian dianalisis menggunakan analisis variansi (ANOVA). **Hasil:** Hasil penelitian menunjukkan bahwa perlakuan yang diberikan memberikan pengaruh yang nyata terhadap persentase bobot karkas puyuh. Perlakuan P3 lebih tinggi nyata dibandingkan dengan perlakuan lainnya, sedangkan perlakuan P2 merupakan yang terendah dibandingkan dengan perlakuan lainnya, sedangkan perlakuan P0 dan P1 tidak berbeda nyata. Parameter lainnya tidak memberikan pengaruh yang nyata terhadap persentase lemak abdomen puyuh, pH, persentase daya ikat air, dan persentase susut masak daging puyuh. **Kesimpulan:** Sebagai kesimpulan, perlakuan memberikan pengaruh yang nyata terhadap persentase bobot karkas puyuh, sedangkan tidak memberikan pengaruh yang nyata terhadap persentase lemak abdomen puyuh, pH, persentase daya ikat air, dan persentase susut masak daging puyuh.

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INTRODUCTION

Quail is a type of poultry as a food source of animal origin to meet human protein needs. There are several types of quail, one of which is most widely raised by the community is the Japonica quail (*Coturnix coturnic japonica*) as a producer of eggs and meat. Quail cultivation has quite large/rapid development prospects because its maintenance is easy, fast and does not require large areas of land. The ability to grow and reproduce quail is very fast, in about 42 days the quail are able to produce and within one year can produce three to four offspring. The body size of quail is relatively small, an adult female quail weighs around 130 grams. This is also profitable because we can raise quail in large numbers on land that is not too large and can also be kept in the yard (Subekti, 2013).

Feed is a factor that greatly influences the growth and development of quail. Quail feed should contain the nutrients needed by livestock to support basic living needs and productivity, including nutrients such as: carbohydrates, proteins, fats, vitamins, minerals, and water. Apart from paying attention to the availability of nutritious feed, quail health management including sanitation is also important to pay attention to. Even though raising quail is relatively easier and faster than other poultry, it also has problems in terms of being susceptible to disease, especially if maintenance management is not good. Diseases that commonly attack quail are diseases that attack the digestive system, such as intestinal inflammation and bacterial infections due to a lack of immune system. If the livestock's digestive system has problems, especially intestinal inflammation, the absorption of feed nutrients will be hampered, resulting in a decrease in body productivity, such as a decrease in body weight and a decrease in carcass performance (quantity and quality).

Herbal plants such as noni and black cumin have active substances that are useful as feed supplements for livestock. Noni leaves contain xeronine which can help absorb protein (Bangun and Sarwhono, 2002) quoted (Purwanto *et al.*, 2021). Hidayati (2006) quoted (Purwanto *et al.*, 2021) stated that poultry given noni leaf extract will increase poultry production. Black cumin has anti-inflammatory, anti-inflammatory, anti-bacterial and many other properties. Noni fruit *(Morinda citrifolia L.*) contains scopoletin, as analgesic, anti-inflammatory and antibacterial; Glycosides, as antibacterial, anticancer and immunostimultan; Alizarin, Acubin, L. Asperuloside and flavonoids as antibacterial (Winarti, 2005). According to Nurhakim (2010), black cumin contains essential oils in which active substances such as thymoquinone are contained and fatty acids by 35.6-41.6% consisting of arachidonic acid, linolenic acid, linoleic acid, oleic acid, palmitic acid, stearic acid and myristic acid. Size The amount of fatty acids contained in black cumin causes easy oxidation occurs. Giving black cumin in the form of flour can increase the live weight and performance of the digestive organs of broiler chickens (Salam *et al.*, 2013). The use of the percentage composition of noni leaf flour and black cumin flour in quail rations refers to the research of Utami *et al.*, (2018) who used a percentage of noni leaf flour of 2.5%, 5%, 7.5% in the ration gave a good response without disturbing the blood profile of local ducks; and in the research of Andini *et al.*, (2022) who used fermented noni leaf flour up to 15% in broiler chicken rations did not have a negative impact on the health of broiler chickens; as well as in the research of Zulkifli *et al.*, (2018) which stated that giving 4% black cumin and heat stress to broiler chickens resulted in an increase in carcass percentage in all treatments.

Providing feed additives in the form of herbal supplements such as noni flour (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) is hoped to increase the body's immunity and improve the quail's digestive system so that it can optimize the absorption of feed nutrients in the intestine and ultimately improve weight performance. Quail bodies and increase the quantity and quality of carcasses. Based on this, it was deemed necessary to carry out research with the Performance of Quail Carcasses with Additional Feed in the form of a Combination of Noni Flour (*Morinda citrifolia L.*) and Black Cumin Flour (*Nigella sativa*). The research aims to calculate and determine the percentage of quail carcass weight and quail abdominal fat.

MATERIAL and METHOD

Material

Tools used during the research is digital scale 1 pcs, treatment feed mixing 4 pcs, feed spoon 4 pcs, knife 1 pcs, jumbo stainless steel basin container 2 pcs. Materials used pullet laying quail 96 tail, commercial feed 100 kg, black cumin flour 1 kg, Noni Leaf Flour 2 kg, clean water 500 litre, ram wire/cage divider 10 m. The nutritional composition of commercial feed, black cumin and noni leaf meal is presented on the table 1.

Tabel 1. The Nutritional Composition of Commercial Feed, Black Cumin and Noni Leaf.

Nutritional Composition	Metabolic Energy (EM) (kkal/kg)	Crude Protein (PK) (%)	Crude Fat (LK) (%)	Serat Kasar (SK) (%)	Kalsium (Ca) (%)	Fosfor (P) (%)
Commercial Feed (Hutama, 2015)	3.032	19-22	3-7	Max 5%	0,9 - 1,2%	0,6-0,9%
Black Cumin (Ghozali, 2018)	41.480	23,38	40,89	12,49	1,94	0,75
Noni Leaf Meal (Utami *et al.*, 2018)	-	21,63	3,06	29,38	2,28	0,28

Research Population and Sample

This research used 6 autumn strain quail aged 45 days with an average body weight of 172 gr in each experimental unit (cage) as there were 4 treatments x 4 replications = 16 experimental unit cages. Research samples were taken at approximately 30 days of age. A total of 2 quail pullets were taken randomly from 16 experimental unit cages so that a total sample of 32 quail were slaughtered and processed into carcasses.

Quail Cultivation

Cultivation begins with an environmental adaptation period of 3 days then continued with maintenance for 4 weeks. Providing rations and drinking water ad libitum. Cleaning of cages and drinking places is carried out every morning. Egg production was recorded every day and ration consumption was recorded once a week. Quail control is carried out every day and records of dead quail. Carcass production was calculated and recorded at the end of the study.

Research Parameters

Live Weight (g/head)

Live weight is the final weight obtained from the results of weighing body weight at the end of research maintenance which is carried out immediately before fasting and slaughter (Ahmad *et al.*, 2016). Carcass is processed chicken meat without blood, feathers, head, feet, neck and innards. Empty carcasses resulting from quail processing were weighed for each treatment (Ahmad *et al.*, 2016). The percentage of poultry carcass weight is influenced by the live weight percentage factor, because carcass weight includes the ratio of carcass weight to poultry live weight, so that a large live weight is also followed by a large carcass weight and vice versa (Qurniawan *et al.*, 2016).

$$\% \text{ Carcass} = \frac{\text{Carcass Weight}}{\text{Live Weight}} \times 100$$

Abdominal Fat Weight (grams)

Abdominal fat is obtained from fat around the gizzard, reproductive organs and between the abdominal muscles, intestines and around the cloaca by taking it using hands and using scissors which is then weighed to determine the weight (Gultom *et al.*, 2012) quoted (Pratiwi *et al.*, 2018). Abdominal fat is obtained by taking fat from the abdominal cavity and around the digestive cavity (Mahfudz *et al.*, 2009) quoted (Pratiwi *et al.*, 2018). Data collection was carried out on female quail of productive age for 30 days, then the amount of abdominal fat taken was expressed in grams/head (Suwito *et al.*, 2014), then the percentage of abdominal fat obtained was calculated using the following formula (Prasetyo *et al.*, 2014).

$$\% \text{ Abdominal Fat} = \frac{\text{Abdominal Fat Weight}}{\text{Live Weight}} \times 100$$

pH, Percentage of Water Holding Capacity (%), and Percentage of Cooking Loss (%)

Test the pH using a pH meter. Water binding capacity was measured using the press method from Hamm (1972) in (Purwana *et al.*, 2018). Meat cooking loss is the percentage of meat weight lost after the cooking process. The formula is (Purwana *et al.*, 2018):

$$\% \text{ Cooking Loss} = \frac{\text{Initial Weight-Final Weight}}{\text{Initial Weight}} \times 100$$

Experimental Design

This research was designed using a Completely Randomized Design (CRD), namely 4 treatments with 4 replications. The treatment structure is as follows: P0 = Commercial Feed, P1 = Commercial Feed + 1% Black Cumin Flour + 3%, Noni Leaf Flour, P2 = Commercial Feed + 2% Black Cumin Flour + 2% Noni Leaf Flour , P3 = Commercial Feed + 3% Black Cumin Flour + 1% Noni Leaf Flour

Analysis Data

The mathematical model that explains each observation value is as follows:

$$Yij = \mu + \tau i + \epsilon ij$$

For i = 1,2,3, 4 ; j= 1,2,3, 4

Information :

Yij = observation value in the ith treatment, jth replication

μ = common mean value

τi = effect of treatment i

ϵij = experimental error in the i^{th} treatment and j^{th} replication

To determine the effect of treatment on the measured variables, the data obtained was tested by analysis of variance (ANOVA) with the help of SPSS Ver software. 16.0. If the treatment shows a real effect, then it is continued with a multiple area test (Duncan) to determine the differences between the treatments (Gasperz, 1994).

RESULT

The performance observed in this study included: live weight, abdominal fat weight, abdominal fat percentage. Meanwhile, quantity are carcass weight and carcass percentage. The quality of quail carcasses includes carcass pH, percentage of water holding capacity, and percentage of cooking loss as shown in Table 2.

Tabel 2. Average Performance, Quantity, and Quality of Quail Carcasses with Additional Feed in The Form of a Combination of Noni Leaf fFour (*Morinda citrifolia L*) and Black Cumin Flour (*Nigella sativa*).

Parameter	Average of Each Treatment			
	P0	P1	P2	P3
Live body weight (grams)	191.71	205.10	204.09	203.34
Carcass weight (grams)	78.51	85.03	80.75	85.15
Abdominal fat weight (grams)	0.98	1.18	0.79	1.09
Carcass percentage (%)	41.04^{ab}	41.39^{ab}	39.51^{a}	41.99^{b}
Abdominal fat percentage (%)	0.50	0.59	0.37	0.54
Carcass pH	5.85	5.86	5.90	5.80
WHC (%)	46.43	44.42	42.12	42.69
Cooking loss percentage (%)	14.05	12.33	14.72	16.93

Note: Different superscripts on the same line indicate significant differences (P<0.05). WHC : Water Holding Capacity. P0 = Commercial Feed; P1 = Commercial Feed + 1% Black Cumin Flour + 3% Noni Leaf Flour; P2 = Commercial Feed + 2% Black Cumin Flour + 2% Noni Leaf Flour; P3 = Commercial Feed + 3% Black Cumin Flour + 1% Noni Leaf Flour.

DISCUSSION

Live Body Weight

Based on the results of analysis of variance, it can be seen in Table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black

cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on the live body weight of quail. Quail between treatments were not significantly different.

The absence of differences in live body weight between treatments could be influenced by the crude protein content contained in each type of feed: commercial feed, additional feed with black cumin flour and noni leaf meal (Table 2) were not much different, namely ranging from 19-24%. The crude protein content in the feed will affect the live body weight of the quail because the protein contained in the feed consumed will be absorbed in the body to form meat/body muscle depending on the animal's feed absorption capacity (FCR). Radhitya (2015) stated that consumption and nutritional content of rations is an important factor in determining quail productivity. In the ration there are nutritional elements that must be available according to the needs of the quail, because if the nutritional content of the ration does not match the nutritional needs of the quail, it will cause a decrease in productivity.

Protein is a food substance needed for growth, basic life and egg production. Protein is also a very important element as a determinant of productivity in *Cortunix cortunix japonica* quail at the age of 3 weeks. The higher the level of protein in the ration, the higher the protein consumed by the quail so that it can meet basic living and growth needs. Higher protein content will result in higher body weight growth as well. Feed conversion is one of the factors to assess the ability of livestock to change feed consumption into a more useful form. The smaller the value produced, the better the ration used so that livestock are more efficient in using the ration. Factors that influence ration conversion are ration composition, protein and energy content of the ration, body size and the availability of nutrients in the ration.

Carcass Weight

Based on the results of analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on quail carcass weight. Quail between treatments were not significantly different. The weight of the quail carcass slaughtered at the age of 12 weeks is from 78–85 gr. This weight is smaller than the research results of Arifin and Widiastuti (2016), which ranges from 102–110 gr, but is still within normal limits. The low carcass weight in this study was influenced by the low body weight of the quail. Resnawati (2002) in Arifin and Widiastuti (2016), states that the ratio of carcass weight to live weight is used as a follow-up to meat production. This is influential because carcass weight and live weight are one of the indicators that influence the carcass percentage. Kulsum *et al*., (2017) stated that the carcass percentage is also influenced by the age of slaughter, where quail that are slaughtered at an old age will experience an increase in head weight and internal organs, so that the carcass percentage decreases. According to Hamdani *et al.,* (2017) carcass weight depends on the type of quail, DOQ quality, quail rearing management, quality and quantity of feed, quail health and quail body size. The standard for slaughtering quail to produce maximum carcass is 6 weeks of age and a maximum body weight of 80 grams (Narin *et al*., 2014). Carcasses are obtained through cutting, cleaning feathers, removing the head to neck, legs and stomach contents of a live quail (Meta and Rita, 2021).

Abdominal Fat Weight

Based on the results of analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on abdominal fat weight. Quail between treatments were not significantly different. The abdominal fat weight from this study ranged from 0.7–1.2 gr. Abdominal fat weight is influenced by how big the quail's body weight is. Wahyono (2012) in Ahdanisa *et al*., (2014) states that abdominal fat accumulation is influenced by several factors including environmental temperature, energy level in the ration, age and gender, and abdominal fat content will increase in line with increasing body weight and age of the animal. Mulyantini (2010) in Sulistyoningsih *et al*., (2016) added that differences in abdominal fat quantity are the result of differences in growth speed. The nature and findings of the study are placed in context of other relevant published data. The discussion should be able to align with the main purpose of research in the Introduction. Caveats to the study should be discussed. Avoid undue extrapolation from the study topic.

Carcass Precentage

Based on the results of the analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had a significant effect (p< 0.05) on the percentage of quail carcasses. Quail between treatments P0 and P1 were not significantly different, but were significantly different between treatments P2 and P3. This difference in carcass percentage was influenced by differences in the proportion of live body weight and quail carcass weight between treatments. The P3 treatment experienced the highest increase in carcass percentage, influenced by the highest carcass weight produced with a live body weight that was not heavier than the P1 treatment. According to Hamdani *et al.,* (2017), carcass percentage is also influenced by several factors, one of which is live weight of livestock. Quail that have a large live weight do not necessarily have a large carcass percentage, because there is still the influence of strain, feed and age at slaughter. The percentage of quail carcasses produced ranges from 39%–42%, and this is still within the normal range. This is as according to Siregar (1994) that the normal carcass percentage ranges from 60% to 75%.

Abdominal Fat Precentage

Based on the results of the analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05)

on the percentage of abdominal fat. Quail between treatments were not significantly different. The abdominal fat percentage of 12 week old quail as a result of this study ranged from 0.3%-0.6%. These results are in line with the research results of Ahdanisa *et al*., (2014) who observed the abdominal fat percentage of male quail aged 8 weeks, which ranged from 0.2%-0.3%. The percentage of abdominal fat is influenced by how much energy content is in the ration given to the quail. Ahdanisa *et al.,* (2014) stated that providing energy in the ration according to needs will result in a low percentage of abdominal fat because energy is one of the factors that influences the percentage of abdominal fat in the carcass. A good quality carcass is one that contains a small amount of fat, thus the treatment that provides the lowest percentage of abdominal fat will be better for the quality of the carcass produced.

Carcass pH

Based on the results of the analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on the pH value of quail carcasses. The pH values between treatments were not significantly different. The pH value of quail carcasses from research results ranged from 5.80 to 5.90. This pH value is relatively the same as the pH value obtained in the research of Purwana *et al*., (2018) which ranges from 5.5 to 5.9. According to Soeparno (2015), changes in the pH value will occur according to the time the meat is stored, the longer the meat is stored, the lower the pH value will be.

Percentage of Water Holding Capacity (DIA)

Based on the results of analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on the percentage of water holding capacity (DIA) of quail carcasses. The percentage of DIA between treatments was not significantly different. The DIA percentage of quail carcasses ranged from 42.12% to 46.43%. The results of this research are slightly higher than the research results of Purwana *et al.,* (2018) which ranged from 33.63% – 40.96%. The high or low level of water that can be bound in meat is influenced by the strength of the meat's structure in binding water so it depends on how high the protein content of the meat is. Meat protein plays a role in binding meat water. High meat protein content causes an increase in the water holding ability of the meat, thereby reducing the free water content (Lawrie, 2003) in (Purwana *et al*., 2018).

Cooking Loss Percentage

Based on the results of the analysis of variance, it can be seen in table 3 that the additional feeding treatment in the form of a combination of noni leaves (*Morinda citrifolia L.*) and black cumin flour (*Nigella sativa*) had no significant effect (p>0.05) on the percentage of quail carcass (meat) cooking loss. The percentage of quail carcass cooking loss between treatments was not significantly different. This is influenced by the pH value and percentage of water holding capacity (DIA) which also do not differ between treatments. Purwana *et al.,* (2018) stated that the value of cooking loss between treatments which is not different is thought to be influenced by the same ultimate pH value of meat, as stated by Lawrie (2003) that a high pH value is relatively more capable of binding water than a low pH value. low. Kartikasari *et al.,* (2018) further stated that the value of cooking loss which did not differ was in line with the value of the water holding capacity of meat which did not differ between treatments. Cooking loss is greatly influenced by the amount of water lost during cooking. One of the factors that causes this is meat protein which can bind water, so the more water the meat protein holds, the less water is released and results in lower cooking losses.

The percentage of carcass (meat) cooking loss of 12-week-old quail as a result of this research ranges from 12% - 17%. These results are in line with the results of research by Purwana *et al.,* (2018) who observed the cooking loss value of layer phase quail meat aged 40 - 44 weeks with papaya leaf extract supplementation in drinking water, which ranged from 26.30%-29.93%.

The treatment given did not have a good effect on the percentage value of cooking loss of quail meat produced because the cooking loss in the control treatment was not different from other treatments, but was still within the normal range. Soeparno (2005) in Kartikasari *et al.,* (2018) stated that the cooking loss value of meat is generally between 1.5-54.5% with a range of 15-40%. Cooking loss affects meat quality, this is related to the loss of meat nutrients during cooking. Meat with a low cooking loss value has better quality compared to meat with a greater cooking loss, this is related to the relatively lower loss of nutritional value of meat during cooking Soeparno (2005) in (Kartikasari *et al*., 2018).

CONCLUSION

Based on the research results, it can be concluded that giving additional feed in the form of black cumin flour (*Nigella sativa*) and noni leaf flour (*Morinda citrifolia L.*) has a significant effect on the percentage of quail carcass weight but has no significant effect on the percentage of quail abdominal fat, pH, percentage of Water Holding Capacity (DIA), and percentage of cooking loss of quail meat.

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CONFLICT of INTEREST

The author declares that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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ETHICAL APPROVAL

This experiment was performed based on approval by the laboratory animals use the health research ethics committee of faculty of medicine [854/UN25.1.10.2/KE/2024], University of Jember, Indonesia.

AUTHORS' CONTRIBUTIONS

Concept and design study: KN, ABA. Research sampling: KN, ABA. Sample analysis and processing data: KN, ABA. Manuscript drafting: KN, ABA. Critical review/manuscript revision: KN.

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