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Utilization of Different Nutrient Infused Chick Gel Mixtures and Its Effect on Chick Quality and Harvest Performance

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Abstract

The study was conducted to determine the response of Cobb® Broiler to different mixture formulations of D-Glucose Monohydrate and multivitamins. Specifically, it determined the growth performance, mortality rate, chick quality, and harvest recovery of Cobb® broiler as affected by different mixtures of D-Glucose Monohydrate and different gel consistency (soft, medium and hard). The experiment used a total of 1,440 chicks from the hatchery following the 2 x 3 factorial in Completely Randomized Design. There were six treatment combinations, and each was replicated three times. Each replication had 80 Cobb® broiler chicks to ensure validity of data. The results of the study showed better chick quality (Pasgar) score for mixture 2 (with higher amount of D-glucose monohydrate) only on Day 0 (farm) immediately right after the transport and at day 4, but no significant differences at day 7. In terms of gel consumption rate, Mixture 2 also had significantly higher consumption than mixture 1, significantly. In terms of body weight, gain in weight, harvest recovery, and mortality rate there were also no significant differences among treatments with different nutrient mixtures and gel consistency.

Keywords: *chick gel, chick quality, broiler, harvest performance*

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Introduction

Despite threats of diseases, importation, and other issues besetting the broiler industry, it continues to be one of the biggest enterprises in the Philippine animal industry. This is due to the good qualities of chicken meat, making it one of the most available and affordable type of meat in the market. In order to support broiler raisers, researches are needed to improve farm production performance starting from the newly-hatched chick.

Within twenty-four hours from hatching, chicks undergo sexing and quality assessment at the hatchery, and are then transported to the farms where they will grow as layers, broilers or breeders. Chick transport is considered as an early stressor since environmental factors can affect the chick quality and can contribute to first week mortality. During transport, dehydration can happen due to the length of transportation period, as well as the temperature and humidity fluctuation while on travel. Transport stress and dehydration can negatively affect the chicks' first week performance.

Researches have been made to lessen the chick transport effects on chick quality and first week performance, such as early nutrition (Hollemans *et al.*, 2018), and the latest innovation is the chick gel, a jelly-based feed material that aims to hydrate the chicks while on transport (Brand). It promises to nourish the chicks with nutrients to support them during the first seven days of life. However, in terms of local applicability and cost efficiency, this product is not yet well studied and supported.

In this research, similar chick gel products that will use locally-available ingredients will be tested, with the aim of providing a sustainable solution for alleviating stress during chick transport and for maintaining chick quality from the hatchery to the farm. The widely-available Cobb broiler strain will be used as experimental animal due to its well-known adaptability to local conditions and its reliable growth performance.

The general objective of this research is to evaluate the response of Cobb® broiler to chick gel of different mixtures with different level of consistency. Specifically, it aimed to: 1) determine the quality of chick through Pasgar scoring; 2) compare the weight gain of broilers as affected by chick gel of different mixtures with different levels of consistency; and 3) compare the harvest recovery and mortality rate among chickens supplemented gel of different mixtures with different level of consistency.

Materials and Methods

Experimental Animals

The study used only Class A, or premium quality day-old Cobb broiler chicks from a reputable hatchery. A total of 1,440 chicks were divided into the 18 groups, or 80 chicks per replicate. For all the weighing schedules, all the 1,440 chicks were weighed by group. For the chick quality assessment via Pasgar method, only 25 % or 20 chicks per replicate were sampled.

Chick Gel Preparation

Prior to the day of chick transport, two mixtures were prepared using different ratios of nutrient mixture (Table 1a). These nutrient mixtures were used in making three types of gel consistencies (Table 1b).

Table 1a

Mixture Formulation of Nutrient-Infused Chick Gel (per 20 heads)

Ingredient	Mixture 1	Mixture 2
D- Glucose Monohydrate	150 grams	240 grams
Multi Vitamins	5 grams	5 grams
Water	2 liters	2 liters

Table 1b

Formulation of Gel Consistencies

Ingredient	Soft	Medium	Hard
Nutrient Mixture	2 liters	2 liters	2 liters
Jelly Powder	25 g	50 g	75 g

In cooking the chick gel, the jelly powder was mixed with the nutrient mixture (depending on the ratio), then placed into a clean cooking casserole and stirred constantly to avoid clumping. The mixture was poured into sanitized gelatin moulders and allowed to cool. To ensure that no cross contamination happened, the researcher used separate cooking utensils for every type of treatment mixture. All utensils were cleaned and disinfected prior to the actual gel preparation.

Once prepared, all mixtures were stored in a chiller to maintain cold temperature, and to avoid spoilage and nutrient degradation. Each chick gel mixture was cut into small pieces and placed in sanitized and labelled containers for easier identification and recording during supplementation.

Supplementation with Chick Gel

The prepared experimental gels were placed inside the chick crates 2 hours prior to chick transport. The chicks had a total of six (6) hours of exposure to the chick gel before and after transport until such time that they were put inside the brooding house.

Labelled containers of chick gel were placed at the center of each crate, where experimental chicks were then placed prior to transport. The chicks were placed in the crates with chick gel after they had undergone initial weighing and initial Pasgar scoring.

After two hours of waiting at the chick holding room, all gel mixture containers were retrieved and weighed, and then replaced with new pre weighed gel mixtures. All retrieved gels were then disposed to ensure only fresh gel mixtures were supplemented before the chick transport. After the gel replacements, chick baskets containing new gel mixtures were placed inside the chick delivery truck and started its transport.

The experimental animals arrived at the farm after two hours of transport. Gel mixture containers were once again collected and weighed to get the final weight after the two hours of exposure during transport. All retrieved gels were then disposed after weighing.

When the chicks were put inside the brooding house of the poultry farm, each cage already contained a new batch of chick gel. To complete the 6 hours total gel mixture exposure, the chick gel were placed inside the brooding cages for two hours, after which all gel mixtures were retrieved, thoroughly cleaned to remove rice hull (litter from the brooding cage floor), and then weighed to determine once again the gel consumption rate.

Chick Quality Assessment

Table 2

Pasgar Chick Assessment Criteria

Characteristic	Class A (Excellent)	Class B (Acceptable)	Class C (Cull)
Reflex	Chick can flip over within 3 seconds	Chick flips back over between 4-10 seconds	Over 10 seconds or fails to flip over
Navel	Clean and well- healed	Closed but slight abrasiveness	Not closed/string/button attached or discolored
Legs	Clean, waxy	Some dryness, pale	Dehydrated with vein protruding
Hogs	Clean, no blemishes	Slight blushing	Red color/ heavy blushing
Defects	Clean, no blemishes	Slight blushing	Legs with cuts/ abrasions; poor feathering; clubbed down; missing eye, cross beak, etc.

In the Pasgar method of chick quality assessment, Class A chicks are assigned perfect 10 points when excellent qualities are possessed (Table 2). One by one, chicks are evaluated through the standard parameters. In each category where the chick fails to qualify in the Class A standards, and gets only the description for Class B, a one-point deduction will be derived. A chick that has any characteristic described under class C is culled and removed from the trial flock. Pasgar scoring was done on Day 0 (Hatchery), Day 0 (Farm), Day 4, and Day 7.

Pasgar scoring evaluation was performed several times all througout the study. First was at the hatchery before the initial supplementation. All evaluated chicks were marked with red dye sprayed at the back of their head for easier identification during the second pasgar evaluation after the 6 hours supplementation where same samples were evaluated. Pasgar scoring was also done during the fourth day and seventh day of growing so the ong term effect of the gel mixtures was meassured.

Figure 1

Sample Pasgar Scoring

Sample Pasgar Scoring

Chick	Reflex	Navel	Beak	Hocks	Belly	Score
1	0	1	1	0	0	8
2	0	0	0	0	0	10
3	1	1	0	0	1	7
.	0	0	0	0	0	.
.	0	1	0	0	0	.
.	0	1	0	0	0	.
50	1	0	0	1	0	8
Total						435

Sample Computation:
Average Pasgar Score = 435/50 = 8.7
Navel Problems in 29 out of 50 Chicks = 58%

Weighing

Weighing of the experimental animals was performed by batch while the chicks are inside crates and computed only the average weight. Hence, all chicks or chickens are placed in pre-weighed baskets or crates, the gross weight is recorded, and then the gross weight was divided into the actual number of heads weighed to get the average weight. This weighing process was done before the supplementation and chick transport, after supplementation or arrival at the farm, and during the 4th, 7th, 14th, 21st, and 28th day of the chickens.

Care, Medication and Harvest

All experimental animals followed the standard care and medication program of Bounty Fresh Food Inc. such as feeding program, lighting program and vitamin supplementation program to ensure chickens were raised in a stress-free environment and free from life threats such as pest and diseases. The experimental animals were also harvested following Bounty Fresh Food Inc. standards to ensure it followed the humane harvesting process.

Data Gathered

The following data were gathered, organized, and subjected to analysis:

1. Chick quality. Chick quality was assessed using Pasgar scoring criteria such as Reflex, Navel, Legs, Hock and Beak. It was done on Day 0 (Hatchery) Day 0 (Farm) Day 4th and 7th.
2. Weight of the Cobb® broiler, this was gathered on the day 0, 4th, 7th, 14th, 21st and final weight on 29th.
3. Average gain in weight, this was gathered through the formula below
   a. AGW = Final weight – Day 0 Hatchery weight
4. Harvest performance. The harvest performance was assessed through getting the harvest rate of the flocks.
   a. Harvest Rate = (No. of chicks harvested/ Total number of chicks) x 100
5. Consumption rate. This was gathered through getting the consumption rate of broiler chicks on the chick gel

Experimental design and treatments

The experiment tested two factors, namely: nutrient mixtures and gel consistencies. The experimental treatments for Factor A (nutrient mixture) were: A1 – Mixture 1, A2 – Mixture 2; and for Factor B (gel consistency) were: B1 – soft, B2 – medium, and B3 – hard.

The experiment was laid out following the 2x3 factorial in Completely Randomized Design (Figure 1), for a total of six treatments replicated three times, or a total of 18 groups. The experimental lay-out was generated using Statistical Tool for Agricultural Research (IRRI, 2013).

Figure 2

Lay-out of the experiment.

A1B1 R3	A2B3 R2	A1B3 R3
A1B3 R1	A1B2 R1	A1B2 R3
A2B1 R3	A1B1 R3	A2B3 R3
A2B3 R1	A2B2 R2	A2B2 R1
A1B3 R2	A2B1 R2	A1B2 R2
A2B2 R3	A2B1 R1	A1B1 R2

Statistical Analysis

All the data gathered from the experiment were analyzed using the Statistical Tool for Agricultural Research (STAR) developed by International Research Rice Institute (2013), employing the analysis of variance (ANOVA) of the Completely Randomized Design. Means were compared using Least Significant Differences (LSD) when there were significant differences.

Results and Discussion

Chick Quality via Pasgar Score

Table 3 shows the Pasgar scores of Cobb® broiler from Day 0 (Hatchery) to Day 7 as affected by different nutrient mixtures of D-Glucose Monohydrate and multivitamins in different gel consistencies.

It is revealed that on day 0 (hatchery), the chicks showed similar Pasgar scores, with a range of 9.80 to 9.87. However, results for day 0 (farm) and day 4 showed that chicks supplemented with Mixture 2 (with higher amount of D-glucose monohydrate) had significantly higher PASGAR scores with a mean of 9.84, compared to chicks given with Mixture 1 with a mean of 9.77. This conforms to Warsito, et al. (2021) who concluded that the use of dextrose leads to better performance of birds as it helps to improve the health of the chicks.

On day 7, chicks supplemented with different mixtures of d-glucose monohydrate showed uniform Pasgar results, with a range of 9.93-9.98. The uniformity at one week age can be due to the quality of chicks raised, all of which are class A which had excellent reflex, navel, legs, hocks and free form defects. Lima (2019) emphasized that healthy chicks are a good starting point for poultry performance. Aside from the chicks were all from class A and were raised in a controlled environment, the quality score of chicks became even higher at day 7 because older chicks are expected to rate higher in many Pasgar criteria, especially in reflex and navel.

Table 3

Chick Quality (Pasgar) Score of Cobb® Broiler Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Day of Assessment	Nutrient Mixture	Consistency			
		Soft	Medium	Hard	Mean
Day 0 (Hatchery)	Mixture 1	9.82	9.87	9.80	**9.83**
	Mixture 2	9.82	9.87	9.87	**9.85**
	Mean	**9.82**	**9.87**	**9.84**	
Day 0 (Farm)	Mixture 1	9.72	9.87	9.73	**9.77b**
	Mixture 2	9.83	9.85	9.85	**9.84a**
	Mean	**9.78b**	**9.86a**	**9.79b**	
Day 4	Mixture 1	9.87	9.9	9.87	**9.88b**
	Mixture 2	9.87	9.95	9.93	**9.92a**
	Mean	**9.87**	**9.93**	**9.9**	
Day 7	Mixture 1	9.98	9.93	9.98	**9.96**
	Mixture 2	9.95	9.98	9.95	**9.96**
	Mean	**9.97**	**9.96**	**9.97**	

No significant effect was observed in terms of the interaction of the two factors; the six treatment groups were statistically comparable.

Body Weight

Table 4

Bodyweight (g) of Cobb® Broiler as Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Day of Assessment	Nutrient Mixture	Consistency			
		Soft	Medium	Hard	Mean
Day 0 (Hatchery)	Mixture 1	43.67	42.67	44.00	**43.45**
	Mixture 2	44.00	43.33	43.67	**43.67**
	Mean	**43.84**	**43.00**	**43.84**	
Day 0 (Farm)	Mixture 1	46.00	44.33	46.00	**45.44**
	Mixture 2	45.67	46.00	45.67	**45.78**
	Mean	**45.84**	**45.17**	**45.84**	
Day 4	Mixture 1	112.67	109.67	111.00	**111.11a**
	Mixture 2	108.33	108.67	107.67	**108.22b**
	Mean	**110.5**	**109.17**	**109.34**	
Day 7	Mixture 1	183.33	184.00	181.33	**182.89**
	Mixture 2	186.63	188.33	183.00	**185.99**
	Mean	**184.98**	**186.17**	**182.17**	
Day 14	Mixture 1	482.33	469.67	471.67	**474.56**
	Mixture 2	498.67	491.67	448.00	**479.45**
	Mean	**490.50a**	**480.67ab**	**459.84b**	
Day 21	Mixture 1	968.33	970.00	981.67	**973.33**
	Mixture 2	974.67	996.33	995.67	**988.89**
	Mean	**971.50**	**983.17**	**988.67**	
Day 28	Mixture 1	1,403.67	1,414.00	1,397.00	**1,404.89**
	Mixture 2	1,384.67	1,437.33	1,405.67	**1,409.22**
	Mean	**1,394.17**	**1,425.67**	**1,401.34**	

Table 4 shows the weight of Cobb® broiler affected by different mixtures of D-Glucose Monohydrate and multivitamins with different levels of consistency.

For day 0, both at the hatchery and farm levels, the Cobb® broilers showed no significant differences in bodyweight, with a range of 42.67-44.00g at the hatchery, and 44.33-46.00g at the farm. These results were used to ensure random distribution of experimental animals.

On the 4th day, birds supplemented with different mixtures showed significant differences on the weight where birds, with mixture 1 showing a significantly higher weight having an average of 111.11g, compared to birds with mixture 2 having an average of 108.22g. On their 7th day, the weight became non-significantly different among birds with different treatments, with a range of 181.33-188.33g, and the average for birds with Mixture 1 was 182.89g and for Mixture 2 was 185.99g.

Meanwhile, on the 14th day, there was observed significant differences among the levels of consistency, where birds given with soft mixture had a highest weight, although still comparable to chicks with gel of medium consistency, and the latter also has comparable weight to birds given with hard consistency. On the 21st day, birds showed comparable weights despite of using different treatment combinations. Analysis of Variance further revealed no significant differences on the final

weight at day 28 of Cobb® broiler chickens as affected by different mixtures of D-Glucose Monohydrate and multivitamins.

In terms of the effect of different consistencies (factor B) on the response variable, analysis of variance revealed no significant variation. However, numerically, birds supplemented with treatments with gel of medium consistency had the highest final weight with 1,425.67g, followed by birds with treatments in hard consistency with 1,401.34g, and by birds with treatments in soft consistency with 1,394.17g.

In terms of the interaction of the two factors, no significant effects are observed statistically. This uniformity in weight during the last weeks of production is due to the class of chicks raised which is class A, as emphasized by Lima (2019) that healthy chicks will give good growth performance.

These results also conform with Hollemans, *et al.* (2018), who concluded in their study that beneficial effects of early chick nutrition provided post-hatch have beneficial effects only on the first two weeks, but the beneficial effects are less evident in later life of chickens. The uniform quality of management implemented during the trial in terms of the controlled environment, feeding, and farm hygiene and sanitation systems also contributed to the uniform weight of the chickens.

Gain in Weight

For the gain in weight, Table 5 shows that in terms of the individual effects of Factor A (Mixtures) and Factor B (consistency), there were no significant differences among groups. In terms of the interaction of the two factors, the birds also showed similar response on the treatment combinations. The obtained final gain in weight ranged from 1,340.67-1,394.00g among the six treatments.

Table 5

Average Gain in Weight (grams) of Cobb® Broiler as Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	**Medium**	**Hard**	**Mean**
Mixture 1	1,360.00	1,371.33	1,353.00	**1,361.44**
Mixture 2	1,340.67	1,394.00	1,362.33	**1,365.67**
Mean	**1,350.34**	**1,382.67**	**1,357.67**	

The result of the study is in line with the study of Baykalir, *et al*. (2021) who used D-Glucose monohydrate to assess the growth performance of geese. The result of the latter revealed that the aforesaid supplement did not show any effect on the growth of the experimental birds.

Chick Gel Consumption

Table 6 shows the consumption rate of Cobb® broiler on chick gel with different mixtures of D-Glucose Monohydrate and multivitamins, as affected by different mixtures, different consistency levels, and their combination.

Table 6

Chick Gel Consumption (g) of Cobb® Broiler as Affected by Different Mixtures of D-Glucose Monohydrate and Multivitamins with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	28.44	21.90	27.36	**25.90** [b]
Mixture 2	35.03	32.73	31.67	**33.14**[a]
Mean	**31.74**	**27.32**	**29.52**	

Analysis of Variance revealed that the consistency of the D-Glucose Monohydrate did not significantly affect the response variable. It is revealed that the consumption rate on D-Glucose Monohydrate of the Cobb® broiler will remain uniform regardless of its consistency. The rate ranged from 27.32-31.74 among the three consistency levels.

In terms of the mixture (Factor A), Cobb® broiler supplemented with Mixture 2 of D-Glucose Monohydrate showed significantly higher consumption rate with 33.14g than experimental animal supplemented with Mixture 1 with 25.90g.

The different mixtures significantly affected the response variable on consumption by the Cobb® broilers due to Mixture 2 having higher amount of D-glucose monohydrate. According to Rodriguez, et al. (2016), higher level of energy can positively affect the feed and consumption efficiency of broiler chickens.

However, the interaction of the two factors did not significantly affect the response variable. The consumption rate ranged from 21.90g to 35.03g among the six treatment combinations.

Harvest Recovery

Table 7 shows the harvest recovery of the experimental animals as affected by different mixtures of D-Glucose Monohydrate with different levels of consistency. ANOVA revealed no significant variation on the harvest recovery on birds supplemented with mixtures 1 and 2 with 98.61% and 98.89% harvest recovery in the two mixtures, respectively. In terms of gel consistency, no significant differences were observed to birds supplemented with treatments with soft, medium, and hard consistency, with a range of 98.54% to 98.96% among the three consistency levels.

Table 7

Harvest Recovery (%) of Cobb® Broiler Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	98.75	98.75	98.33	**98.61**
Mixture 2	98.75	99.17	98.75	**98.89**
Mean	**98.75**	**98.96**	**98.54**	

Furthermore, the interaction of the two factors showed no significant differences on the response variables. Thus, the supplementation of the D-glucose monohydrate with different consistency did not affect the harvest recovery on flocks, with a range of 98.33% to 99.17% among the six treatment combinations.

Since all the birds received supplementation, they prove the assertion of Shengru (2019) that D-glucose monohydrate supplementation can improve the growth performance of broiler in terms of enhancing the digestive function of gut which improve apparent digestibility and digestive enzyme and can improve health which leads to low death and morbidity and leads to low depletion.

Mortality

Table 8 shows the mortality rate on broiler affected by different mixtures of D-Glucose Monohydrate with different levels of consistency.

Table 8

Mortality (%) on Cobb® Broiler Affected by Different Mixture of D-Glucose Monohydrate with Different Levels of Consistency

Mixture	Consistency			
	Soft	Medium	Hard	Mean
Mixture 1	1.27	1.27	1.70	**1.41**
Mixture 2	1.27	0.83	1.27	**1.12**
Mean	**1.27**	**1.05**	**1.49**	

ANOVA revealed that different mixtures did not significantly affect the mortality rate of the Cobb® broiler. The obtained average mortality rate for Mixture 2 was 1.12%, while Mixture 1 had 1.41%.

In terms of the effect of different consistency, ANOVA also revealed no significant differences. The mortality rates on broilers supplemented with treatments in different consistency levels are statistically similar at the range of 1.05% to 1.49%. Also, the interaction of the two factors showed no significant effect on the latter response variable.

According to Shengru (2019), d-glucose monohydrate or dextrose supplementation can improve the growth performance of broiler in terms in enhancing the digestive function of gut which improve apparent digestibility and digestive enzyme and can improve health which leads to low death and morbidity.

Conclusion

Based on the results of the experiment, the following conclusions were drawn: 1) Mixture with higher amount of D-glucose monohydrate had a positive effect on the quality of chicks after supplementation until 4th day; 2) Different mixtures with different consistency showed no effect on the weight and weight gain of Cobb® broiler; and 3. Different mixtures with different consistency also showed no effect on the harvest recovery and mortality rate on Cobb® broiler.

Recommendations

Based on the results, the following recommendations are made: 1) Use of chick gel with 240 g of d-glucose monohydrate may be done by broiler farms if they want to maintain chick quality during their early days of life; 2) Utilize chick gel for Class B broiler chicks may be studied to determine if it can improve chick quality and performance after supplementation; and 3) Use of chick gel may be studied in farms without controlled environment system to see if supplementation can improve growth performance if management and environment are not optimum.

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