Mineral-Vitamin Combining Versus Herbal Supplementation to Enhance Performance *Ongole Crossbred* Bull

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**Abstract.** Excellent performance of bull as sperm producer was needed to maintain and increase the high pregnancy cows rate. The study aimed to determine the effect of mineral-vitamin combining [MVC] and herbs supplementing [HS] on feed intake, feed efficiency, average daily gain [ADG], linear body, semen quality and B/C ratio of *Ongole Crossbred* bull.

Eight animals [aged 3 to 5 years] within initial weight 505.2 ± 70.5 kg were examined. They were grouped in two feed regimes, firstly, the basal diet was given with the inclusion of Vitamin A, E and Zinc-minerals [P1] and secondly, were basal diet plus herbs supplementation [P2]. The basal diet consisted of elephant grass, gliricidia, and commercial concentrates. Feeding was assigned to dry matter [DM] of 3% of body weight [BW] to meet the balance nutrient intake. The experimental which conducted as long as three months, was designed in two treatments and four replicates. Data analysed by using the T-test. There was no significant different between P1 and P2 in the results on feed intake, efficiency, ADG, and linear body. However, the sperm concentration of P1 [1,366.7 ± 768.9 million/ml] was higher [P<0.05] than those of P2 [873.3 ± 488.7 million/ml]. Meanwhile, the sperm viability of P1 [90.4 ± 8.5%] was also higher than that of P2 [78.7 ± 16.2%]. Both P1 and P2 were recommended for being used commercially [due to requirement of Indonesia National Standard/SNI 4869-1:2017], but the P1 was the efficient one in regards of the B/C ratios.

**Key word:** Mineral-vitamin combining, herbal supplementation, bull.

1. **Introduction**

Feeding in a balanced manner is needed to avoid providing excessive or insufficient nutrition so that it can have an impact on the growth of cow bull to produce fresh semen with a minimum motility of 70%[1]. Feed deficiency is associated with a decrease in testicular weight, sperm motility and sperm concentration [2], while excess feed is associated with a decrease in semen quality and abnormal thermoregulation of the testes [3]. Increasing concentrate intake in a diet can change specific behavior and improve abnormal behavior that can harm bull[4]. Limitation of the application of balanced feeding is based on DM and CP. The performance of growth and reproduction of beef cattle was optimized by herbal supplementation. Herbal feed additives can enhance immune function, antioxidants, antimicrobials and growth effects in livestock[5]. Traditional herbs available in Indonesia, among others *Allium sativum*, *Curcuma xanthorrhiza*, *Curcuma longa*, *Alpinia alangalang*, *Ananas comosus*, *Piper longum*, *Sauropus androgynous*, *Piper betle*, *Zingiber officinale*, *Keempferia galangal*, *Zingiber zerumbet*, and *Curcuma aeruginosa*. The group of cows given *Allium sativum* had a total increase in weight and a higher addition of daily weight gain compared to controls[6].
Supplementation of *Curcuma xanthorrhiza* affects the digestibility of CP and CF in lactating FH cattle[7]. Supplementation of herbal mixtures consisting of dried cinnamon [*Cinnamomum zeylanicum*], turmeric root [*Curcuma longa*], rosemary leaves [*Rosmarinus officinalis*] and clove buds [*Eugenia caryophyllata* Thunb] plus giving flax seed extraction can increase glucose metabolism profile and antioxidant status in dairy cows that experience a transition period of physiological conditions[8]. Previous research, traditional herbal mixtures such as Javanese chili [*Piper retrofractum* Vahl], curcuma [*Curcuma xanthorrhiza* Roxb.], Temuireng[*Curcuma aeruginosa*], galangal [*Alpinia shipyard*], sambiloto[*Andrographis paniculata* Ness], pasakbumi[*Eurycoma longifolia*], purwoceng[*Pimpinella alpinae* Molk.] can be given to support libido and semen quality[9].

Therefore, based on the composition and efficacy the results of previous research on herbs. The purpose of this study was to determine the effect of herbs supplementing on feed consumption, feed efficiency, average daily gain [ADG], linear body, semen quality and B/C ratio of PO bull.

2. Methodology

The study was conducted in the experimental pens of Indonesian Beef Cattle Research Institute[BCRI]for eight weeks. Feed analysis was carried out at the Nutrition Laboratory of BCRI. Eight PO bull with an initial body weight of 505.25 ± 70.52 kg were used as materials, with ages ranging from 3.5 years. The basal feed given every day for each bull were: elephant grass [15 kg], gliricidia leaves [1.5 kg], concentrate I [6 kg] and concentrate II [3 kg] with each nutrient content of feed ingredients found in Table 1. Feed is given with a percentage of DM of <3% of BW and CP<11% of DM.

| Feed Ingredients [%] | Dry Matter | Crude Protein | Crude Fibre | Ether Extract | Ash | BETN | TDN |
|----------------------|------------|---------------|-------------|---------------|-----|------|-----|
| Elephant Grass       | 23.3       | 4.15          | 1.17        | 19.08         | 7.53 | 68.07| 48.12|
| Gamal                | 31.17      | 19.26         | 3.56        | 18.64         | 9.63 | 48.91| 69.16|
| Concentrate I        | 90.81      | 16            | 5.97        | 12.53         | 8.2  | 57.3 | 77.15|
| Concentrate II       | 92.54      | 7.26          | 3.14        | 24.17         | 11.69| 53.73| 56.32|

**Table 1**. Proximate Analysis of Feed Material

Animals were divided into two groups randomly, each group consisted of four and placed in individual house. Each animal is given the same basal feed with different types of herbs. The control group [P1] was given vitamin A [3,900 IU/kg DM], vitamin E [60 IU/kg DM] and Mineral Zinc [30 mg/kg DM] and treatment group [P2] were given Herbal Supplementation [HS][15 ml/three days]. HS is a commercial herbal in the form of liquid with an herbal mixture consisting of *Allium sativum, Curcuma xanthorrhiza, Curcuma longa, Alpiniaalangal, Ananascomosus, Piper longum, Sauropus androgynous, Piper betle, Zingiber officinalis, Keempferia galangal, Zingiber zerumbet, and Curcuma aeruginosa*. Before the implementation of the research, each animal was given an identity, and the feed was carried out by a proximate analysis. Weighing body weight is done every two weeks at the same time, while weighing feed consumption was measuring every day for two months. At the beginning and end of the study a linear body measurement was carried out in the form of hearth girth[HG], body length[BL], wither height[WH], hip height [HH], BCS and scrotum circumference. BW[kg] is obtained by weighing the liveweight using a digital weighing capacity of 1000 kg; while for the linear body measurement is done by: 1) HG is obtained by wrapping a measuring tape on the chest behind the hump; 2) data on BLobtained by measuring the distance from the shoulder bump [humeri tuberosity] to the tip of the sitting bone [tuber ischia], using a measuring stick; 3) data of WH is obtained by measuring the distance from the flat surface of the ground until the highest part of the shoulder passes through the scapula perpendicularly, using a measuring stick; 4) HH should be taken at a point directly over the hip bones [hooks] with the animal standing on a level surface, using measuring stick[10] and 5) BCS uses a scale of 1-9 [11]. The parameters observed were body weight, feed consumption, ADG, linear body measurement, semen quality and B/C ratio. Data were analyzed by t-test using SPSS for Windows version 23[12].
3. Results and Discussion

Feed Intake
Consumption of DM, CP, CF, TDN, ADG and feed efficiency between P1 and P2 showed that the results were not significantly different [Table 2]. P1 and P2 are able to maintain ADG of 0.56 kg/head/day and 0.62 kg/head/day respectively by giving ration weight <3% BW, this is almost the same results of Rasyid and Luthfi[2017] that PO cattle aged 24 - 36 months given feed treatment 3% DM ration showed ADGof 0.50 ± 0.08 kg/head/day. Hapsaristates that the administration of ginger extract [Zingiberofficinale] increases fermentability of feed in the rumen seen from high VFA concentrations and low NH3[13]. High VFA concentrations describe the condition of a balanced rumen pH so that the rumen microbes are able to work well in the fermentation process. Holstein cows supplemented with phytobiotics-rich herbal mixture [PRHM] consumed more feed and showed a level of feed efficiency[14].

The second DM treatment in accordance with the yearling intake growing bull standard in Beef Cattle Nutrient Requirements Model BCNRM [2018] for 500 kg BW with ADG ranging from 0.6 kg/head/day requires feed intake based on DM of 11.16 kg with a percentage of suitability 107%. Consumption of CP in the study of 10.71% DM for P1 and 10.73% DM for P2 tended to be higher than the standard CP intake based on BCNRM of 7.7%. This figure shows that the consumption of CP PO bull is 139% from the BCNRM standard. TDN consumption of P1 was 63.68% DM and P2 63.70% DM was greater than the standard TDN BCNRM intake of 58.4% DM, the percentage of TDN consumption compared to the BCNRM standard was 109% for P1 and P2. These results show that consumption of DM and TDN is close to the BCNRM standard, while consumption of CP is far greater than the BCNRM standard.

| Feed consumption [kg/day] | Treatment | P Value |
|---------------------------|-----------|---------|
| P1 | P2 |
| Dry Matter[DM] | 11.95 ± 0.40 | 11.93 ± 0.42 | 0.915 |
| DM[% BW] | 2.17 | 2.59 |
| Crude Protein [CP] | 1.28 ± 0.52 | 1.28 ± 0.50 | 0.973 |
| CP[% DM] | 10.71 | 10.73 |
| CrudeFiber[CF] | 2.07 ± 0.68 | 2.07 ± 0.70 | 0.899 |
| CF[% DM] | 17.32 | 17.35 |
| Total Digestible Nutrient [TDN] | 7.61 ± 0.28 | 7.60 ± 0.28 | 0.950 |
| TDN [% DM] | 63,68 | 63.70 |
| Average daily gain[ADG] [kg/day] | 0.56 ± 0.60 | 0.62 ± 0.42 | 0.722 |
| Feed efficiency [kg ADG /kg BW consumption] | 0.046 ± 0.049 | 0.052 ± 0.035 | 0.719 |

Description: P1: Vitamin A, Vitamin E and Zinc Minerals; P2 : Herbs Supplementation

Phytochemical Content of HS
HS contains active compounds of flavonoids, polyphenols and saponins[Table 3]. Flavonoids can increase ruminant productivity with beneficial effects exhibited under a variety of stressful condition [15]. Supplementation Delonixregiaseed contains high condenses tannins and saponins at 270 g/d resulted in improving total feed intake, rumen fermentation and N balance while there was reduced DM digestibility, protozoal population and CH4 production in beef cattle. Polyphenol oxidase [PPO] mediated protein-quinone binding has been linked to protecting plant proteins from proteolysis. Protein identifications revealed preferentially retained proteins localised within the chloroplast, suggesting that PPO mediated protection in the wild-type operates due to the proximity of target proteins to the enzyme and substrates, either diffusing into this compartment from the vacuole or are present in the chloroplast. This increased understanding of protein targets of PPO indicates that wider exploitation of the trait could contribute to increased protein use efficiency[16].

Linear Body Measurement
The parameters measured were HG, BL, HH, WH, and scrotum circumference between P1 and P2 in the initial to the end periods showed not significant difference[Table 4]. P1 and P2 both produce a
percentage of growth with a positive value, except for the scrotum circumference at P1 which shows a negative value. Linear body parameters had increasing size except for the scrotum circumference. The increase in the size of the scrotal circumference P1 show a negative value, while P2 shows positive value. Livestock do not have the ability to store zinc in the body so that it requires a consistent supply to avoid changes in physiological functions of the body. The scrotum circumference had a very significant effect \[P<0.01\] on semen volume, sperm concentration and semen motility in Bali cattle\[18\].

### Table 3. Phytochemical content of HS

| Herbal Containing | Flavonoids | Polyphenols | Tannins | Terpenoids | Alkaloids | Saponins |
|-------------------|------------|-------------|---------|------------|-----------|----------|
| HS                | +          | +           | -       | -          | -         | +        |

*) containing of HS[17].

### Table 4. Linear Body Early and End of PO Bull

| Parameter                | Period   | P1                  | P2                  | P Value |
|--------------------------|----------|---------------------|---------------------|---------|
| Heart girth [cm]         | Early    | 189.00 ± 12.19      | 179.50 ± 7.60       | 0.234   |
|                          | End      | 200.25 ± 5.80       | 189.75 ± 8.62       | 0.090   |
| Body length [cm]         | Early    | 148.75 ± 15.67      | 144.00 ± 3.92       | 0.578   |
|                          | End      | 164.00 ± 8.79       | 158.50 ± 10.50      | 0.453   |
| Wither height [cm]       | Early    | 136.88 ± 2.78       | 139.25 ± 2.63       | 0.261   |
|                          | End      | 139.00 ± 4.16       | 140.38 ± 0.75       | 0.540   |
| Hip height [cm]          | Early    | 143.50 ± 5.05       | 147.75 ± 3.30       | 0.209   |
|                          | End      | 147.50 ± 2.65       | 148.00 ± 3.02       | 0.812   |
| Scrotum circumference [cm]| Early    | 37.25 ± 2.22        | 34.75 ± 0.50        | 0.070   |
|                          | End      | 36.75 ± 1.71        | 36.50 ± 1.73        | 0.844   |

Description : P1: Vitamin A, Vitamin E and Zinc Minerals; P2: Herbs Supplementation

**Semen Quality**

The semen volume and sperm motility of P1 and P2 were not significantly different, but for sperm concentrations and sperm viability showed significantly different results. Viability and sperm concentration on P1 were better than P2. The quantity and quality of semen in P1 and P2 has met the SNi standard for fresh semen to be produced into frozen semen with a minimum motility of 70% \[1\].

Bull cattle were given trace minerals [Zn, Cu, Co and Mn] for 60 days can maintain sperm motility ≥ 70% [19]. Herbal supplementation with zinc content can increase testosterone levels in plasma, libido, and sperm motility of Bali cattle\[20\].

### Table 5. Semen Quality of PO Bull

| Parameters                        | P1                  | P2                  | P Value |
|-----------------------------------|---------------------|---------------------|---------|
| Semen Volume [ml]                 | 5.89 ± 2.41         | 4.57 ± 1.83         | 0.097   |
| Sperm Concentration [million/ml]  | 1,366.67 ± 768.92\(^a\) | 873.33 ± 488.71\(^b\) | 0.045   |
| Sperm Motility [%]                | 70.94 ± 12.68       | 70.77 ± 11.70       | 0.971   |
| Sperm Viability [%]               | 90.41 ± 8.5\(^a\)    | 78.73 ± 16.21\(^b\) | 0.019   |

Description P1: Vitamin A, Vitamin E and Zinc Minerals; P2: Herbs Supplementation. Superscript different letters on the same line show significant differences \[p <0.05\].

**Benefit Cost Ratio**

B/C ratio is a comparison between the result presented in value and costs capital as an indicator of whether or not it is acceptable an investment that is carried out. B/C ratio criteria provide guidelines that the project will be selected if B/C ratio rather than 1, and vice versa if a project has a B/C ratio of less than 1 then the project will not be selected[21]. The results showed that the two treatments produced a B/C ratio>1. These results showed that both treatments provided positive benefits. This value means that every Rp. 1,00 investments issued by farmers can add a profit of Rp. 1,174 for P1 and Rp. 1,135 for P2. The greater the value of B/C ratio means an increasingly profitable business.
The biggest gain at P1 and P2 was obtained from making frozen semen straws, while for the benefits obtained from ADG tended lower.

### Table 6. Benefit Cost Ratio

| Variable                     | P1         | P2         |
|------------------------------|------------|------------|
| ADG Revenue                  | 27,927.54  | 31,155.56  |
| Straw frozen semen           | 321,990    | 159,640    |
| Total Revenue                | 349,917.54 | 190,795.56 |
| Feed Fee                     | 40,050     | 40,050     |
| Supplementation Fee          | 334        | 333        |
| Fee for making frozen semen straw | 257,592   | 127,712    |
| Total Expenditures           | 297,976    | 168,095    |
| Benefits                     | 51,941.54  | 22,700.56  |
| B/C ratio                    | 1.174      | 1.135      |

Description: P1: Vitamin A, Vitamin E and Zinc Minerals; P2: Herbs Supplementation

* Price of cow per kg body weight :Rp. 50,000 ; assuming the cost of making one straw is 80% x Rp. 7000** = Rp. 5600;

### 4. Conclusion

It can be concluded that P2 can help maintain optimal growth to support PO bull performance as semen producer according to SNI standards, but it is not different than that of P1 which based on benefits obtained. Further research was needed by adding the amount of cow material and increasing the research observation period by three cycles of spermatozoa [180 days] to be able to see further influenced of HS on feed consumption, growth, and semen quality of PO bull as semen producers and the benefits obtained.

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