The economic value of velvet from Timor deer captive breeding at Dramaga Forest Research

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Abstract. One product of innovations produced from captivity breeding of Timor deer (Rusa timorensis Blainville, 1822) is antler and called velvet. Velvet powder is the primary raw material for traditional medicines, which is commonly used in China and Korea. These products are potentially derived from economic value. This study aims to determine the production of velvet in Timor stag in captive at Dramaga Forest Research, Bogor. This study used as many as 12 individuals Timor stags, consisting of 3, 5, 7 and 9 years old classes, each of three individuals age classes. The body weight varies of Timor stags are from 35.07 ± 1.91 kg to 66.5 ± 7.37 kg. Observations were carried out during 2016 - 2019. The parameters observed were deer age, velvet age, body weight, velvet weight, and velvet powder weight, and the number of capsules produced. The observations show that velvet may be harvested at 60.25 ± 1.26 days. The 3, 5, 7 and 9 years old of deer produce are 364.6 ± 31.37 mg velvet powder or 12 bottles; 917.2 ± 408 grams or 14 bottles; 1,469 ± 659 grams or 49 bottles; and 1527.5 ± 265 grams or 51 bottles, consecutively. The price of velvet powder is IDR 100,000 per bottle containing 30 capsules.

1. Introduction
Indonesia has a rich biodiversity of wildlife with considerable potential, including ecological, biological, aesthetic, germplasm sources, nature recreation, education and science. On the other hand, people's needs for wildlife products tend to increase from year to year. The increase in demand for wildlife can be seen from the use of meat and skin as a source of animal protein and as a raw material for making bags, shoes, wallets, belts or belts, and many other parts of wildlife that can be used to support human life.

Deer is one of the wildlife that has potential in the future due to a high economic value. The meat is a source of low-cholesterol animal protein, and its demand is increasing as human population growth in Indonesia. In the future, deer meat is a potential substitution to cow meat due to its low cholesterol. Other derived products of deer are skin and velvet. Deerskin is quite elastic and can be used as a material in the leatherscraft industry. Besides, deer velvet (young ranggah) is useful as a source of raw materials for traditional medicines, which are very expensive in China and Korea.

Forest Research and Development Center (FRDC) is a scientific institution that has a role in species conservation. There are three deer species in this captive breeding; Timor deer (Rusa timorensis Blainville, 1822), Sambar deer (Rusa unicolor Kerr, 1792), and Bawean deer (Axis kuhlii...
Muller, 1840). The Timor deer ex-situ conservation has been carried out in Dramaga Forest Research since 2008, with the current number is 32 individuals, consisting of 23 males and nine females. This breeding has resulted in the fifth generation and expected to provide a high economic outcome. According to [1], the results of the second derivative breeding and after can be utilized.

One of FRDC innovations from captivity breeding of Timor deer is velvet. Velvet or young deer antler are found in Timor stag and contain nerve and blood vessels. Velvet powder is used as a natural supplement that has high economic value. Through this innovation, velvet is processed and made into a powder so that humans can easily consume it. This innovation is expected to provide an opportunity to explore the potential of Timor deer optimally by developing alternative products that have economic and conservation value by utilizing deer without killing. The purpose of this study was to determine the total production of Timor deer velvet at Dramaga Forest Research captive breeding, velvet morphometrics to be harvested, the content of the elements contained in velvet powder and the benefits and economic value of selling velvet powder in one harvest.

2. Research method

2.1. Material and tools

The study was conducted on captive breeding in the Dramaga Forest Research, Bogor, Indonesia. This research lasted for three years, starting from 2016 - 2019. Twelve individual Timor stags consisting of 3, 5, 7, and 9 years old classes were used for this study. Replication used were three individuals of Timor stag from the four age classes, with the average body weight 35.07 ± 1.91 kg - 66.5 ± 7.37 kg (Table 1). The equipment used during the research was a clamp enclosure, camera, meter, caliper, pH meter, anesthesia equipment, writing instruments, tally sheets and a set of computers (Microsoft Excel software). Cutting velvet used including anesthetic, scales, knives, hacksaw, hand-counter, stopwatch, alcohol, vacuum tube, syringe needle, scissors, icebox, cover cloth, wound medicine or iodine tinctures, rubber gloves, plastic mine, transparent plastic bags, plastic sacks, face masks, cage shoes and sterile cotton.

The nutritional content of Timor deer velvet powder in Dramaga Forest Research (FR) was analyzed in several laboratories, namely amino acids (chromatography/HPLC), and fatty acids (chromatography/GC). The analysis was carried out in the chemical laboratory of the Forest Product Research and Development Center. Pathogenic microbial (bacterial and fungal) tests were analyzed at the Laboratory of the Veterinary Research Center, Ministry of Agriculture.

| No. | Age of deer (month) | Body Weight (kg) | Average | Standard Deviation |
|-----|---------------------|------------------|---------|--------------------|
| 1.  | 3                   | 33.5             |         |                    |
| 2.  | 3                   | 37.2             | 35.07   | 1.91               |
| 3.  | 3                   | 34.5             |         |                    |
| 4.  | 5                   | 46.0             |         |                    |
| 5.  | 5                   | 48.0             | 48.17   | 2.02               |
| 6.  | 5                   | 50.0             |         |                    |
| 7.  | 7                   | 65.7             |         |                    |
| 8.  | 7                   | 60.0             | 58.23   | 8.49               |
| 9.  | 7                   | 49.0             |         |                    |
| 10. | 9                   | 74.5             |         |                    |
| 11. | 9                   | 60.0             | 66.5    | 7.37               |
| 12. | 9                   | 65.0             |         |                    |

2.2. Methodology

The research was conducted with stages of technical preparation (secondary data collection, work plan preparation, material and tools preparation), velvet harvesting, velvet processing, data collection and
analysis. The parameters observed were deer velvet measurements (right, left weight, branch length, and total circumference). The research methods used were an observation with direct measurement of the velvet from Timor stag. Purposive sampling was used in this study.

The velvet harvesting techniques were conducted as follows: inserting selected deer into a clamp enclosure, covering the head and face of selected deer with black cloth to avoid stress, tying the base of the velvet using a thick and strong rubber band to avoid vascular vessel bleeding during the time cutting, and injecting local anesthetics. Harvesting of velvet was carried out on Timor stag from the third branch that has perfectly branched, reaching an average age of 60.25 ± 1.26 days.

2.2.1. Velvet harvesting. Initially, the Timor stag had to be selected before harvesting. The criteria selection was based on the following criteria: a). The interval age of stags of 3 – 15 years old, b). Having a minimum of three branches of velvet antlers (Figure 1). The others are minimum growth age of velvet of about 60 days, and healthy deer body condition [2, 3].

![Figure 1. Perfect velvet growth period. (Photo: Sudaryo, 2018)](image)

2.2.2. Processing techniques. The anesthetics containing Lidocain, Xylazin, or Ketamineis used. The doses of one ampule were injected in each velvet or 1 mg per kg of deer body weight [4]. The injections were applied surrounding at three-point on the bottom of velvet (Figure 2). The propose of using local anesthetics was to reduce or to eliminate pain during velvet cutting.
Figure 2. Injection of a local anesthetic around the bottom of the velvet.
(Photo: Setio, 2011)

Velvet cutting was done with a sharp and clean tool (hacksaw) with a saw blade that had been sterilized using disinfectant and liquid antiseptic (®dettol and 70% alcohol). Cutting was done quickly, starting with the right velvet and continuing with the left velvet at which was remaining about 1-2 cm from the bottom of the velvet ring.

The following process of velvet cutting was to clean the scar using an antiseptic liquid that was gently rubbed on the former cut. The binding rubber was released, and then the remaining blood at the cutting area of the velvet was cleaned. The fabric of the headcover was removed, and the deer was released slowly from the pinch cage and placed in an isolated cage, so the deer were not inferior to other stags.

Velvet morphometry (weight, length, and circumference) was measured after the cleaning process. Furthermore, the clean velvet was wrapped using aluminum foil and stored in a freezer with a temperature of -4 °C. Velvet could be stored for about two months. In processing velvet, frozen velvet was removed from the freezer and thawing was done. When it was melted, the velvet was thinly sliced like chips and then put in the oven at 45°C for six hours. After six hours, the oven temperature was set to 50 °C for six hours, and then the next six hours, the temperature was raised again to 55 °C. Sliced velvet that has been dried removed and milled using a mixer so that it became smooth as powder. Velvet powder was filled into capsules, which each capsule contains 250 mg of powder. Finally, the capsule was put in a sterilized packaging bottle first (Figure 3).

Figure 3. Packaging of Timor Deer velvet powder.
2.3. Data analysis
Velvet was obtained, made into powder, and analyzed in the laboratory of the Center for Post-Harvest Research and Development and the Tropical Biopharmaca Study Center, Bogor.

3. Results and Discussion
3.1. Size of velvet morphometrics
The ranggah growth of Timor stag has four stages, namely the pedicle (where the growth of velvet shoots), velvet, hard terraces, casting, or non-fracturing. These stages were repeated every year in sequence. Velvet growth stages are covered by fine or velvety feathers and many blood vessels. The first growing of velvet Timor deer starts at the age of 10.48 ± 3.36 months, and the growth interval between right and left is 2.00 ± 0.71 days [5]. While [6] and [7] reported that the initial velvet growth of Timor deer in Java occurred within 5-7 months. The age of the deer may influence these differences. Other factors were food nutrition consumed, deer genetics, diseases, and breeding management.

Young velvet or straw was harvested at three years old (Table 2). Period harvesting velvet on Timor deer was carried out from 55 to 65 days while in sambar deer 50 -55 days [6]. [4] said that harvesting velvet on 4-6-year-old Timor deer was carried out at 63.00 velvet ± 3.6 days with velvet length 19.6 ± 3.92 cm, while [2] and [3] reported that harvesting period of velvet ranged from 54 - 67 days (60.67 ± 6.51 days).

Table 2 showed that the morphometric size of velvet was measured based on Timor stag ages. The largest morphometric size in velvet stag on Dramaga Forest Research was reached at the age of seven years, where the weight of fresh velvet 609.80 ± 143.22 grams with velvet length reached 27.67 ± 4.09 cm and diameter 10.33 ± 0.29 cm. According to [3], the maximum length of the deer in Timor deer reaches 78.8 cm, and the diameter is 29.84 - 52.75 mm. [5] stated that a three-year-old Timor deer with a bodyweight of 48.0 kg in Nusa Tenggara Timur (NTT) has a fresh velvet weight of 404.96 grams. Whereas [4] reported proper harvesting of velvet when its length had reached 25.0 m.

The difference in velvet morphometric size on Timor deer depends on age, deer type feed, and deer management techniques. Velvet weight begins to decline, along with the increase in age [8]. The results of the study prove that the highest velvet growth at the age of nine years began to decrease both weight and length and diameter. According to [9], the productivity of young Timor deer is 0.84 kg/individual with a productive period of up to 18 years, but the utilization period is only up to 15 years.

3.2. The physical characteristic of velvet powder
The results of the study on 12 individual Timor stag age consisting of three years, five years, seven years and nine years in captive deer breeding in Dramaga FR has produced velvet powder, as shown in Table 3.
Table 3. Results of processing velvet into powder.

| No. | Deer Age (year) | Fresh Velvet Weight (gram) | Powder Weight (gram) | Capsul Total (piece) |
|-----|----------------|-----------------------------|----------------------|----------------------|
| 1   | 3              | 207.1                       | 66.8                 | 267.0                |
| 2   | 3              | 179.2                       | 63.6                 | 254.0                |
| 3   | 3              | 172.2                       | 51.9                 | 208.0                |
|     | Average        | 186.2±18.46                 | 60.77±7.84           | 243.0±31.0           |
| 1   | 5              | 467.1                       | 168.9                | 676.0                |
| 2   | 5              | 525.5                       | 171.7                | 687.0                |
| 3   | 5              | 526.0                       | 346.9                | 1388.0               |
|     | Average        | 506.2±33.86                 | 229.17±101.97        | 917±408              |
| 1   | 7              | 771.5                       | 531.0                | 2124.0               |
| 2   | 7              | 559.0                       | 368.7                | 1475.0               |
| 3   | 7              | 498.9                       | 201.7                | 807.0                |
|     | Average        | 610.0±143                   | 367.13±164.66        | 1,469.0±659.0        |
| 1   | 9              | 520.0                       | 342.9                | 1,372.0              |
| 2   | 9              | 522.0                       | 344.3                | 1,377.0              |
| 3   | 9              | 695.0                       | 458.4                | 1,834.0              |
|     | Average        | 579.0±100.0                 | 381.87±66.28         | 1,528.0±265.0        |

Velvet weight produced from the study was lighter than the velvet production derived from crossing breed of Timor and sambar deer in Australia [10], which is an average velvet production of 1.34 ± 0.23 kg and the average of body weight is about 105.86 ± 1.34 kg. Velvet weight production on Sambar deer in North Paser Regency, East Kalimantan was 900 grams (for individuals I) with 25 cm velvet length and 13.5 cm diameter and 700 grams (for individuals II) with a length of 26 cm and a diameter of 11.25 cm [2]. The differences may be caused by deer species, deer body weight, velvet shape and size and maintenance patterns, including feed intake with high levels of protein and minerals [11]. For example, Sambar deer has a much larger body size than Timor deer, as well as the velvet condition. [3] reported that mineral contains velvet is not significantly in the difference of the harvesting time (P > 0.05), except in the gradient of Amino acid. The gradient amino acid may increase in line with the harvesting time. Besides, there were signs in gradient contain between phosphor mineral and essential protein of fodder to velvet production.

3.3. Chemical characteristic of velvet powder

The chemical composition contained in velvet powder was twelve (12) mineral components, including phosphorus, potassium, calcium, magnesium, sodium, sulfur, iron, aluminum, manganese, copper, zinc, and boron [2]. The mineral content medically has effects related to osteoporosis, growth and development, and healing of bone in humans, the beauty of the skin and maintaining stamina [12].

The nutritional content of velvet from Timor deer produced by Dramaga Forest Research was eight types of macro and micro mineral elements. Those elements are Ca (Calcium), P (Phosphorous), K (Potassium), Na (Sodium), Mg (Magnesium), Mn (Manganese), Se (Selenium), Fe (Iron); nine essential amino acids, namely histidine (His), arginine (Arg), methionine (Met), isoleucine (Ile), leucine (Leu), phenylalanine (Phe), lysine (Lys), threonine (Thr), and valine (Val); while the content of non-essential amino acids is eight types, namely aspartate (Asp), glutamate (Glu), serine (Ser), glycine (Gly), alanine (Ala), proline (Pro), tyrosine (Tyr) and systein (Sis). Complete results can be seen in Tables 4 and 5.

Velvet powder is a renewable resource harvested from Timor deer without endangering animals. Velvet powder is a structure in cartilage and is useful for improving stamina function, especially in men. Furthermore, according to [13], velvet antler powder has been used as a traditional animal-based medicine in the East and in traditional Chinese medicine to prevent or treat various diseases, including...
cardiovascular disease, gynecological problems, immunological deficiencies and blood cancers. It also promotes tissue repair and also exerts health promotion.

**Table 4.** The chemical compound extracted from Timor deer velvet in Dramaga Forest Research captive breeding.

| No. | Compound Name | Concentrate (%)* | Benefit** |
|-----|---------------|------------------|-----------|
| 1   | Acetic Acid   | 11.94            | An important group for biochemistry ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 2   | 1H-Pyrrole (CAS) Pyrrole | 4.19 | Synthesis protein, biosynthesis asam amino ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 3   | Phenol (CAS) Izal | 0.75 | Antiseptics and disinfectants. Phenol (Indonesia) actively kills many types of micro-organisms, including some fungi and viruses. Phenol is used to reduce itching; it is also used in the production of cosmetics including sunscreens, hair dyes and skin lightening ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 4   | Acetic Acid 4-Acetoxy-5-Acetoxymethyl-2-Oxo-Tetrahydro-Fi Phenol, 4-methyl-(CAS) p-Cresol | 0.81 | Metabolism on Cytoplasm and Extracellular ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 5   | 2,3-Dehydroperipinid-6-one | 1.32 | Antioxidant production ([https://en.wikipedia.org](https://en.wikipedia.org)) |
| 6   | 4,8-Dimethylona-1,7-Diene | 1.69 | Substance between anti-Alzheimer's agents ([http://www.chemicalbook.com](http://www.chemicalbook.com)) |
| 7   | 2-Piperidinone (CAS) 2-Piperidone Benzene, 3-pentenyl-, (Z)-(CAS) 5-Phenyl-CIS-2-Pentene Cyclohexane, 1,2,3-trimethyl-, (1. alpha.,2. alpha., 3.beta)-(CAS) 1, Trans-2 | 1.18 | Extracellular metabolism and membranes |
| 8   | 2-Piperidinone (CAS) 2-Piperidone Benzene, 3-pentenyl-, (Z)-(CAS) 5-Phenyl-CIS-2-Pentene Cyclohexane, 1,2,3-trimethyl-, (1. alpha.,2. alpha., 3.beta)-(CAS) 1, Trans-2 | 2.40 | Piperidine is widely used in the synthesis of organic compounds, including drugs. Contains alkaloids that provide nerve stimulants and provide a hot spicy taste Nutrien, metabolisme on cell membranes ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 9   | 2-Piperidinone (CAS) 2-Piperidone Benzene, 3-pentenyl-, (Z)-(CAS) 5-Phenyl-CIS-2-Pentene Cyclohexane, 1,2,3-trimethyl-, (1. alpha.,2. alpha., 3.beta)-(CAS) 1, Trans-2 | 3.39 | Flavoring agent. Metabolism on cytoplasm dan extracellular ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 10  | Pentanoyl chloride (CAS) Valeryl chloride Benzen, (3-methyl-4-pentenyl)-(CAS)3-Methyl-5-Phenyl-1-Pentene | 0.49 | Characterized by a distinctive deer smell. Used as ingredients for perfume esters, nutrients, stabilizers, surfactants and emulsifiers. Extracellular metabolism and membranes |
| 11  | Pentanoyl chloride (CAS) Valeryl chloride Benzen, (3-methyl-4-pentenyl)-(CAS)3-Methyl-5-Phenyl-1-Pentene | 1.72 | Nutrien and metabolism on cell membranes ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 12  | Benzene Benzen, (3-methyl-4-pentenyl)-(CAS)3-Methyl-5-Phenyl-1-Pentene | 1.99 | Nutrien, metabolism on cell membranes ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 13  | Benzene Benzen, (3-methyl-4-pentenyl)-(CAS)3-Methyl-5-Phenyl-1-Pentene | 2.49 | In low concentrations, it has the smell of flowers and is found in several flowers and essential oils, including orange flowers, jasmine, and bidara. It is used as an aroma and fixative in many perfumes and as an aromatic compound |
| 14  | Benzene Benzen, (3-methyl-4-pentenyl)-(CAS)3-Methyl-5-Phenyl-1-Pentene | 4.66 | Metabolism on Cytoplasm and extracellular ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| 15  | 4-Pyrimidinol, 5-(aminomethyl)-2-methyl- | 5.47 | Metabolism on Cytoplasm and extracellular ([http://www.hmdb.ca/metabolites](http://www.hmdb.ca/metabolites)) |
| No. | Compound Name | Concentrate (%) | Benefit** |
|-----|---------------|----------------|-----------|
| 16  | (+)-Epilupinine 3-Cyclopent-1-one, 2-hydroxy-3-(3-methyl-2-buteryl)-(CAS) | 6.15 | Antioxidant, cell regeneration and alkaloid |
| 17  | (+)-Epilupinine | 2.60 | Same as above |
| 18  | 1-(5,6-Dimethyl-2-Pyrazinyl) Propanone Phenol, 2,6-dimethoxy-4-(2-propenyl)-(CAS) 4-Allyl-2,6-dimethoxyphenol 9- | 2.29 | Same as above |
| 19  | Borabicyclo[3.3.1]Nonane, 9-(2-Propan-1-Yloxy)- | 5.58 | Nutrien |
| 20  | N-Phenyl-N'-Furaldehyde Hydrazone Hexahydro-Pyrrolizin-3-One | 1.12 | Nutrien |
| 21  | 1,4-Diaza-2,5-Dioxobicyclo[4.3.0]Nonane | 2.15 | Same as above |
| 22  | Borabicyclo[3.3.1]Nonane, 9-(1,2-Dimethylpropyl)-5,10-Diethoxy-2,3,7,8-Tetrahydro-1H,6H-Bicyclo[2.2.1] Heptan-3-On, 2-Benzoxyl-1,7,7-Trimethyl-Benzoic acid, 2,4-Dihydroxy-, Methyl Ester (CAS) 2,4-Dihydroxybenzoic | 4.22 | Metabolism on Cytoplasm and extracellular metabolism (http://www.hmdb.ca/metabolites) |
| 23  | 9-Octadecanamide, (Z)-(CAS) Oleoamide | 3.30 | Metabolism on Cytoplasm and extracellular metabolism (http://www.hmdb.ca/metabolites) |
| 24  | Hexadecanamide (CAS) Amide 16 | 3.09 | Metabolism on Cytoplasm and extracellular metabolism (http://www.hmdb.ca/metabolites) |
| 25  | Cholesta-3,5-diene (CAS) Cholesterolene | 2.09 | Secondary metabolites of salicylic acid which have been hydrolyzed by liver enzymes during the metabolic phase |
| 26  | 1,4-Diaza-2,5-Dioxobicyclo[4.3.0]Nonane | 1.62 | Inhibits CANCER cell proliferation, Cell signaling, fuel and energy storage, fuel or energy sources, Membrane integrity stability (https://pubchem.ncbi.nlm.nih.gov) |
| 27  | 9-Octadecanamide, (Z)-(CAS) Oleoamide | 1.23 | Antidpresi, regulator multi neurotransmitter. Nutrients, stabilizers, surfactants dan emulsifier |
| 28  | Hexadecanamide (CAS) Amide 16 | 0.23 | Fuel and energy storage. Fuel or energy source. Membrane integrity stability. (https://pubchem.ncbi.nlm.nih.gov) |
| 29  | Cholesta-3,5-diene (CAS) Cholesterolene | 0.65 | Secondary metabolites of salicylic acid which have been hydrolyzed by liver enzymes during the metabolic phase |
| Total | 100 | | |

Source: * Results of Analysis of Research and Development of Forest Products
** Results of Search for Center for Industry & Agro

The results of the analysis of the content of Timor deer velvet powder carried out in the Laboratory of Forest Product Research and Development Center, in each gram of velvet samples containing 10 compound elements namely acetic acid, phenols and their derivatives, benzene and derivatives, chlor and derivatives, amino acids (aminomethyl) and their derivatives, amino acids (lysine) & their derivatives, ethanol and derivatives, methyl esters and their derivatives, cholesterlaine & derivatives and hexadecanamide (amide) and their derivatives. The results of laboratory tests are only limited to protein and fat elements, not including elements of minerals and vitamins. Whereas according to [2],
the results of laboratory analysis showed that mineral elements in velvet powder were almost equivalent to the results of velvet analysis abroad (Table 5).

Table 5. Mineral and essential elements in Timor deer velvet powder at Dramaga Forest Research captive breeding.

| Mineral Content | Velvet Value | Velvet Reference Value of Processed Product* | Function ** |
|-----------------|--------------|---------------------------------------------|-------------|
| P (%)           | 4.67 1.27    | 5.80                                        | It is the structure of bones and teeth and as a component of almost all metabolic reactions |
| K (%)           | 0.33 0.14    | 0.42                                        | Essential for nerve and muscle function and involved in electrolyte balance |
| Ca (%)          | 10.90 2.24   | 12.10                                       | Build and maintain healthy teeth and bones, and nerve impulse conduction needs to keep the heart beating continuously, keeping muscles and nerves working properly |
| Mg (%)          | 0.28 0.04    | 0.25                                        | Required for normal bone, tooth and nerve formation and muscle function |
| Na (%)          | 0.94 0.08    | -                                           | Helps the body maintain normal electrolytes and fluid balance |
| S (%)           | 0.14 0.10    | 0.85                                        | A component of various amino acids and insulin |
| Fe (ppm)        | 194.33 31.75 | 319.00                                      | Blood cells need to carry oxygen throughout the body |
| Al (ppm)        | 47.33 19.40  | -                                           | Needed for bone formation and connective tissue, the formation, and activation of certain enzymes |
| Mn (ppm)        | 4.67 2.08    | 3.40                                        | Required for energy production, the formation of red blood cells, bones and connective tissue and has antioxidant actions to help protect cells against damage by free radicals |
| Cu (ppm)        | 3.00 1.00    | 5.30                                        | A component of more than 100 enzymes needed for healthy skin, wound healing and growth |
| Zn (ppm)        | 64.33 12.42  | 69.00                                       | |
| B (ppm)         | 4.00 1.00    | -                                           | |

Description: * Source (http://www.velvita.com/composition.htm)

** Source Ewashkiw, C and M. Allen. 2011 (http://www.norelkco.com)

Source: Takandjandji, Setio & Garsetiasih, 2011

3.4. Use of velvet deer powder

The uses of deer velvet based on the research result are well known. The uses of Timor deer velvet powder are to:

1. Increase sexual potential
   Deer velvet powder in Russia is used for sufferers of sexual disabilities (impotence and other sexual dysfunction). Velvet powder can also have an androgenic and gonadotropic effect, which helps regulate the activity of sex organs. [6] show deer velvet containing biologically active ingredients that are efficacious for male and female sex organs so that it is useful to overcome biological problems.

2. Effect of tonic
   In Russia in the 1930s, testing was carried out on deer velvet (pantocrin) to help soldiers who were wounded by the war returned strong and healthy. Velvet extract (pantocrin) acts to
accelerate the natural healing process in the body by increasing its resistance to adverse external influences [6, 14].

(3.) Improve blood circulation
Velvet is also useful for dealing with obstruction of blood vessels so that it improves blood circulation. Velvet can also reduce the risk of fatal heart attacks and strokes [14].

(4.) Add blood
Deer velvet can increase the number of erythrocytes and stimulate red blood cell synthesis, hemoglobin, leukocytes, and can increase the acceleration of cell rejuvenation [14].

(5.) Overcoming the effects of aging
Deer velvet extract can increase testosterone levels in male rats while reducing enzyme levels associated with the aging process [15].

(6.) Improve muscle ability
The average health of athletes increases after consuming pantocrin [14].

(7.) Accelerating wound healing and according [16] that velvet antler extract appears to promote anti-fatigue effects.

(8.) Deer velvet extract can speed up the healing process of nerve tissue damage, sores, ulcers and emotional complaints.

In addition to the benefits as mentioned above, velvet is also used to prevent osteoporosis, prevent kidney, improve sexuality, increase immunity, promote blood circulation, and increase energy [14]. Another surprising benefit of deer velvet is that it can overcome health problems such as kidney problems, can overcome male sexual problems that decline. Even some Chinese people believe, if people drink fresh blood of deer velvet, their vitality will get stronger. The statement was justified by health experts and stated that deer velvet is very beneficial for health, especially to overcome erectile dysfunction problems. Therefore for Chinese people, deer velvet is a precious treasure because, since the Chinese empire, deer velvet and deer were often used as alternative medicine.

3.5. Velvet economic value
Velvet powder will be sold for IDR 100,000, - per bottle (containing 30 capsules). This price is adjusted to the price of sambar deer velvet powder in East Kalimantan, which sells for IDR 100,000 - per bottle (Table 6). However, until recently, it has not been freely marketed because it is still waiting for "halal" certification from the Institute for Food and Drug Studies and Consumption (IFDSC) Indonesian Ulema Council (IUC). The "halal" information, whether or not a product is this is very important. Law No. 33 of 2014 concerning Guaranteed "Halal" Products explains that products that entered, circuated and traded in the territory of Indonesia must be "halal" certified. So, if this product is sold, it must be "halal" certified, have marketing licenses, trade business licenses, and import permits.

Table 6. The economic value of deer velvet powder from Dramaga Forest Research captive breeding.

| No. | Deer Age (year) | Capsule Total (a capsule) | Bottle Total (bottle) | Total Income (IDR) |
|-----|----------------|--------------------------|----------------------|--------------------|
| 1   | 3              | 267.0                    | 9.0                  | 900,000            |
| 2   | 3              | 254.0                    | 8.0                  | 800,000            |
| 3   | 3              | 208.0                    | 7.0                  | 700,000            |
| Average | 243.0±31.0 | 8.0±1.0 | 800,000 |
| 1   | 5              | 676.0                    | 22.0                 | 2,200,000          |
| 2   | 5              | 687.0                    | 23.0                 | 2,300,000          |
| 3   | 5              | 1,388.0                  | 46.0                 | 4,600,000          |
| Average | 917±408 | 31.0±14.0 | 3,033,000 |
4. Conclusions

Based on the study in the four age classes of Timor stag (3, 5, 7 and 9 years old), the highest wet weight of velvet is at seven years (609.8 ± 143.22 grams) with an average harvest time of 60.25 ± 1.26 days. Dry weight after being processed into powder occurs shrinking from wet weight by 32.63 ± 2.70% at the age of three years; 44.93 ± 18.29% aged five years; 58.40 ± 15.63% aged seven years and 65.95 ± 0.01% aged nine years.

The mineral content produced from velvet is 12 components and contains eight types of macro and micro minerals: Ca, P, K, Na, Mg, Mn, Se, Fe; nine essential amino acids: histidine, arginine, methionine, isoleucine, leucine, phenylalanine, lysine, threonine, and valine; and eight types of non-essential amino acids: aspartate, glutamate, serine, glycine, alanine, proline, tyrosine and cysteine. Velvet powder also contains a compound of Hexadecanamide with a concentration of 1.23%, which can inhibit cancer cell proliferation. Amino acid content contained in velvet deer Timor powder is thought to be used as a source of bioactive peptides that are used as anti-cancer agents.

The velvet production of Timor stag in captive breeding at Dramaga Forest Research may derive one of the potentials high economic value without having to kill the deer. This can be considered as an additional opportunity value for local breeder communities around the site to improve welfare. Therefore, this innovative product is necessary to be considered in deer breeding cultivation.

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