THE ESTIMATION OF CARCASS TRAITS OF BALI BULLS USING ULTRASOUND

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ABSTRACT

A study was conducted to collect information on Bali bulls carcass traits estimation as one of the selection criteria using ultrasound. Ultrasonic estimation of carcass traits such as M. *longissimus thoracis* area (MLTA), Subcutaneous Fat Thickness (SFT), Inter Muscular Fat Thickness (IMFT), Rib Thickness (RT) and Beef Marbling Score (BMS) were obtained from 92 head of bulls at Barru district and 74 head of bulls at Bone district, South Sulawesi, Indonesia. The carcass traits estimation were scanned between the 6^{th} - 7^{th} ribs using ultrasound. The ultrasound is made of Fujihira Super-Eye FHK, Co. Meat. Ltd. with B-Mode and electronic linear probe, which used frequency of 2 MHz. The carcass traits estimation photos were printed by video-copy machine (Aloka Co. Ltd., SSZ-300S). The data obtained were analyzed using basic statistic and was discussed descriptively. The averages of all carcass traits estimation of the Bali bull at Bone district at 12, 18 and 24 months of ages were higher than those at Barru district. The MLTA estimation of Bali bulls at Bone and Barru districts were 18.0 cm^2, 24.3 cm^2, 23.8 cm^2 *Vs* 16.6 cm^2, 18.5 cm^2, 23.3 cm^2, respectively; the BMS estimated were 0.14, 0.24 and 0.20 *Vs* 0.00, 0.15 and 0.17, respectively; the SFT estimation were 0.26 mm, 0.33 mm, 0.34 mm *Vs* 0.28 mm, 0.26 mm, 0.34 mm, respectively; the IMFT estimation were 1.13 mm, 1.24 mm, 1.31 mm *Vs* 0.97 mm, 1.06 mm, 1.14 mm, respectively; the RT estimation were 2.04 mm, 2.52 mm, 2.72 mm *Vs* 1.19 mm, 2.12 mm, 2.30 mm, respectively. The growth of MLTA, SFT, IMFT, RT and BMS of the bulls of Bali cattle at the 12, 18 and 24 months of age were not reaching the optimally performances, yet. Therefore the selection process of the bulls of Bali cattle to be candidate of sire based on the estimation of carcass traits should be done after since 4 years of age.

Keywords : Bali bulls , estimation of carcass traits, selection, ultrasound

INTRODUCTION

Bali cattle are the native cattle of Indonesia that have to be saved from the threat of extinction and invasion of the foreign breed of cattle that entered to Indonesia with the reason to achieve self-sufficiency in meat under the "*Program of Swasembada Daging*". The Bali cattle are one of the beef cattle breed in Indonesia who can supply the needs of meat in Indonesia. Beside that Bali cattle is also known as the king of the beef cattle breed at the East of Indonesia. South Sulawesi is known as one of the central of the beef cattle outside Java. Therefore, to contribute the sustainability of the population and reproduction of Bali cattle in Indonesia, the Barru and Bone District South Sulawesi are expected to be one of the central of cultivation and purification of Bali cattle in Indonesia.

Bali cattle as one of the germplasm preserved from extinction. However the performance, the population and the condition of genetic quality of Bali cattle in South Sulawesi was decreasing into critical situation. The Bali cattle performances are getting smaller and it makes the impact on the meat quantity produced.

The efforts to improve the genetic quality of Bali cattle are absolutely done by doing the selection of dam, sire, bull and heifer. But the main problem in selection activity in Indonesia is the lack of completeness of recording, pedigree, production and reproduction data.

Ultrasound has been commonly used as one tool in the selection of livestock in abroad (Aiken, *et al*., 2002), but the research information by using ultrasound of Bali cattle in Indonesia is very

rarely. The biggest advantages using ultrasound in the process of livestock selection is the superior cattle are not lost in vain. Therefore, the growth of carcass traits associate with the genetic quality could be monitored in living animals that the genetic potential of the candidate cattle could be inheritaged continuously. Several studies have shown that RTU traits measured in yearling bulls and heifers have positive genetic correlations with corresponding carcass traits of progeny (Reverter, *et al*., 2000; Crews and Kemp, 2001; Bertrand, 2002).

The accuracy of ultrasound to estimate carcass traits in live cattle compared to other several methods is high. Ultrasound is very potential as a tool for cheaper, easier, faster with high degree of accuracy in evaluating carcass traits of the candidate of cattle (Rouse *et al*., 1993 in Sri Rachma, 2001).

The use of ultrasound in selecting of the candidate cattle is very helpful for the growth of the quality and quantity of meat beside that the body weight are also could be monitored at regular time, routine and more accurate (Sri Rachma *et al*., 2000a-b; Sri Rachma, 2006). Usually, the growth of carcass traits were evaluated at each maintenance phase by slaughtering the livestock or after become the carcass. The slaughtering of the best candidate cattle makes the difficulties in determining the growth pattern when the estimates of carcass performances of bulls or heifers are needed at the performance test or progeny test.

Several research have been reported the estimation of carcass traits such as MLTA, SFT and BMS in the Europe and Japan cattle in live condition using ultrasound with those level of accuracy (Sri Rachma *et al*., 2000a-b). Now, the ultrasound are used as a tool for direct selection of livestock, especially for carcass traits (Sri Rachma *et al*., 2000a-b). Live measurements of body composition using ultrasound scanning of subcutaneous fat depth and eye muscle area have been shown to be useful as indicator traits for carcass composition in genetic evaluations (Crews *et al*., 2003; Reverter *et al*., 2003). Those results make more exciting condition of breeders in abroad to participate to improve the genetic quality of their cattle.

It is time to repair and improve the genetic quality, quantity and population of Bali cattle in South Sulawesi. Therefore, it required a variety of information about the bulls and heifers to be replacement stock, such as: carcass traits, body dimensions, pedigree, history of reproduction, etc. Those activities are the major activity in the selection and breeding program of livestock. The objectives of this study were to obtain the information of carcass traits after weaning until 2 years of age as a first step to select the best replacement stock to improve the genetic quality of Bali cattle.

MATERIALS AND METHODS

Experimental animals

Ultrasonic estimates of carcass traits were obtained from 92 head of bulls at Barru district (Mangkoso, Siddo, Ajakkang, Lawallu, Lampoko and Kirukiru villages) and 74 head of bulls at Bone district (Tirong, 1, 2, 3 villages) South Sulawesi. Those bulls were reared in semi traditional system fed field grass and added by elephant grass, corn straw and peanut leaves occasionally. The estimated of carcass traits were done periodically at 12, 18 and 24 months of age.

Scanning procedures and Parameter traits

Ultrasonic scanning was done between the 6^{th} – 7^{th} rib on the left side of each animal, based on the slaughtering carcass standard of Japan Meat Grading Association, to obtain the carcass estimates of MLTA, SFT, IMFT, RT and BMS (Figures 1 and 2). Harada (1982) found the Super-Eye MEAT, which is produced by FHK Co. Ltd., Japan with the electric linear probe (2 MHz frequency, 27 mm x 147 mm), to be superior in accuracy for carcass traits estimated of Japanese cattle. The MLTA's photo that is taken by ultrasound is transferred to the tracing plastic and the areas were calculated using the grid paper with 100 boxes per size of 1 cm^2. The assessment of SFT, IMFT and RT were done directly on the photographic paper using slide rules. Especially for BMS assessment were done subjectively using the scale of assessment score were between 0.00 (the lowest); 0.33/0+; 0.67/1-; 1.00/1; 1.33/1+; 1.67/2-; 2.00/2; 2.33/2+; 2.67/3-; 3.00/3; 4.00/4 and 5.00/5(the highest) based on Beef Carcass Grading Standard (Meat Journal Association, 1989). The data were analyzed using SPSS version 10.0 for Windows.

RESULTS AND DISCUSSION

The growth of livestock is measured by weight gain, while the development of livestock can be measured by body size or carcass traits.

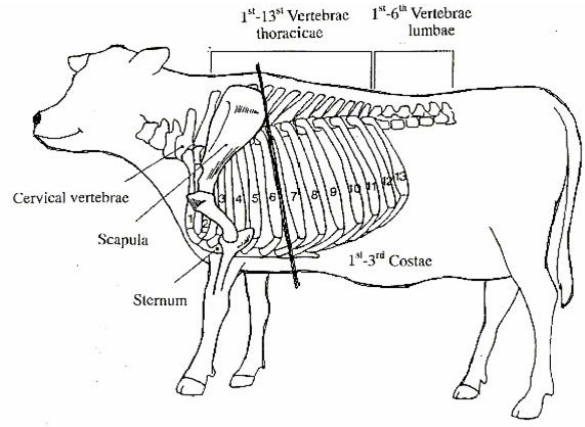

Figure 1. The Slaughtering Location Between the 6^{th}-7^{th} ribs

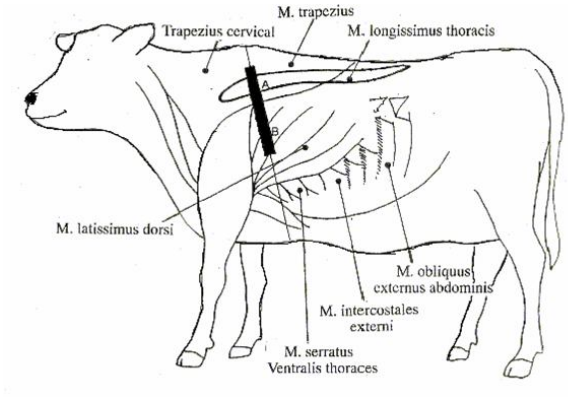

Figure 2. The Probe Location Between the 6^{th}-7^{th} ribs

The weight and body size combinations are commonly used as a measure of growth. The fat accumulation was occurred after the animal reaches the mature because the fat tissue is the latest growing tissue. Fat proportion is strongly influenced by age and body weight. Animal that are reared on natural grazing, does not provide adequate nutrition to enable the large and fast growing animals to express their genetic potential for growth (Norris, *et al*., 2002)

The growth of MLTA and BMS of the Bulls of Bali Cattle at Barru and Bone District of South Sulawesi

The estimation of MLTA is the most common estimator of total carcass muscle and is used in yield grade calculation (Williams, 2002). MLTA is the biggest muscle in the livestock's body. MLTA is influenced by body weight of livestock. The cattle that have big MLTA tend to have higher body weight (Sri Rachma, 2001). The estimate of MLTA and BMS of Bali bulls at the age of 12, 18 and 24 months are presented in Figures 3 and 4.

Generally, the average of MLTA and BMS of of Bali bulls at the 12, 18 and 24 months of age at Bone district were higher than those at Barru district. The trend of growth of estimated MLTA at both of district was similar while the BMS of Bali bulls at Barru district were growing more rapid than those at Bone district.

BMS of all ages were close to score 0 on Beef Carcass Grading Standards (was approaching score of 0.00). Those results shows that the fat distribution among the meat fibers as one of the determinant factor of carcass quality has not seen and still grow (Figure 5). Bruns *et al*. (2004) established that marbling score increase consistently during the growth.

Rahim (2005) reported that the average of estimated MLTA and BMS of the fattening Bali bulls of 1-2 years of age was 24.97 cm^2 and 0.12/0. The growth of MLTA's area and BMS of Bali bulls at Barru and Bone district is lower than the Japanese Black cattle at the age of 12 months such as 32.6 cm^2 / 0.71 (Sri Rachma, 2001). Crews and Kemp (2002) noted that in studies of MLTA involving the composite yearling bull (0.25 Charolais, 0.25 Simmental, 0.44 British [Angus, Hereford, Shorthorn], 0.06 Limousin) was 69.07 cm^2. Beside that the MLTA estimated of 12 and 18 months of ages of Angus steers were 60.3 cm^2 and 92.3 cm^2, respectively. The MLTA of yearling Brangus bulls, Simmental bulls and yearling Angus bulls were higher (71.8 cm^2, 81.3 cm^2 and 81,3 cm^2) in Stelzleni *et al*. (2002); Crews *et al*. (2003); MacNeil and Northcutt (2008), respectively. The differences may be attributable to bull's age and breed differences beside the feeding quality – quantity differences that affect to the ability of gene to spur the growth of intramuscular fat. Bertrand (2002) pointed out that the continental European breeds given their later maturity and potential for limited fat deposition by yearling age. The low BMS in the bulls of Bali cattle are also may caused by the bull's age which is still the growing age. At one year of age, Bali cattle in this study were still growing, with little tendency for fattening. This condition make the fat deposition among meat fiber has not significantly formed.

The growth of SFT, IMFT and RT of Bali Bulls at Barru and Bone District of South Sulawesi

The SFT measurement is directly related to carcass yield grade (Williams, 2002). The

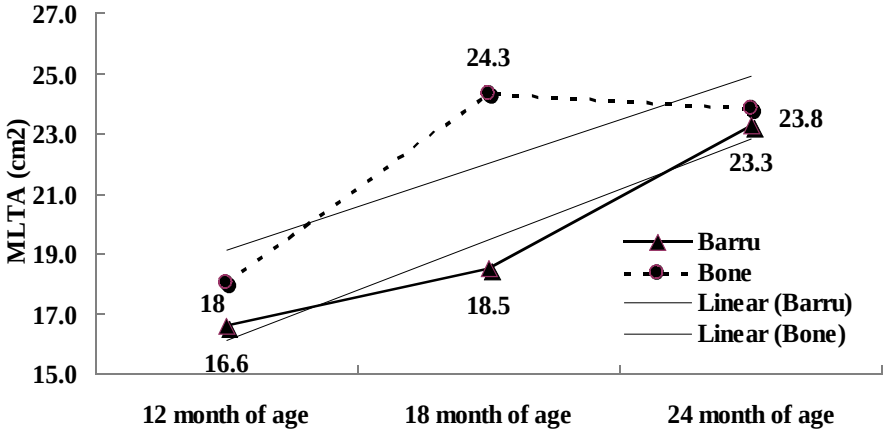

Figure 3. The Growth of MLTA of the Bali Bulls at Barru and Bone District

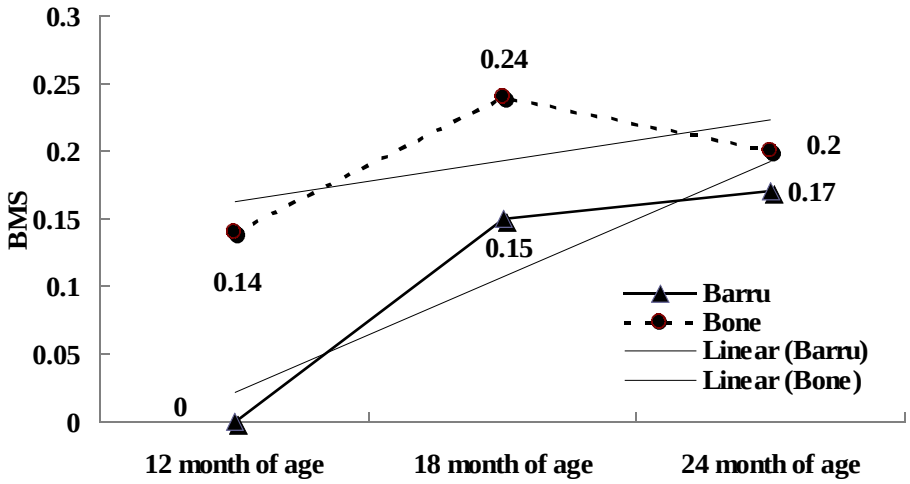

Figure 4. The Growth of BMS of the Bali Bulls at Barru and Bone District

estimate of SFT, IMFT and RT of Bali bulls at the age of 12, 18 and 24 months are presented in Figures 6, 7 and 8.

Cattle are different from pig because the cattle are less fat deposition under the skin than pig. Those differences in the ability of subcutaneous fat producing gene make the subcutaneous fat of cattle is not expected to grow too much.

Generally, the average of estimated SFT, IMFT and RT of Bali bulls at the 12, 18 and 24 months of age at Bone district were thicker than those at Barru district. But the growth trend of SFT and RT of Bali bulls at Barru district were more rapid than those at Bone district while the growth trend of IMFT were similar both district. That conditions also show that the growth of SFT, IMFT and RT of the bulls of Bali cattle at the 12, 18 and 24 months of age in both of district have not reached the optimally performance (Figure 9).

The results of beef fat level of Bali cattle were low. The average of estimated subcutaneous fat of Bali bulls at Barru and Bone district were very thin compared to the Japanese Black bulls at the age of 12 (7.0 mm), 16 (8.1 mm) and 20 (9.3 mm) months, respectively (Sri Rachma, 2001); the Bali bulls at the age of 1-2 years (2.11 mm) (Rahim, 2005); the yearling bulls of Angus cattle (7.5 mm) (MacNeil and Northcutt, 2008). Crews and Kemp (2002) reported that the SFT estimated

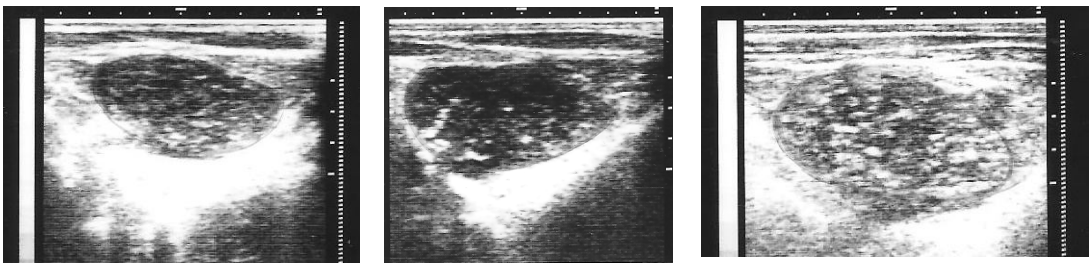

Figure 5. The MLTA and BMS of the Bali Bulls at the 12, 18 and 24 Months of Age

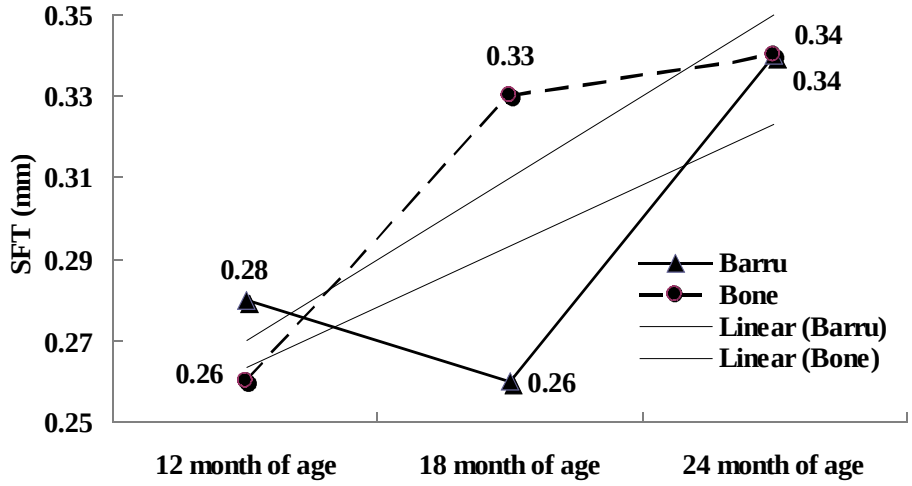

Figure 6. The Growth of SFT of the Bali Bulls at Barru and Bone District

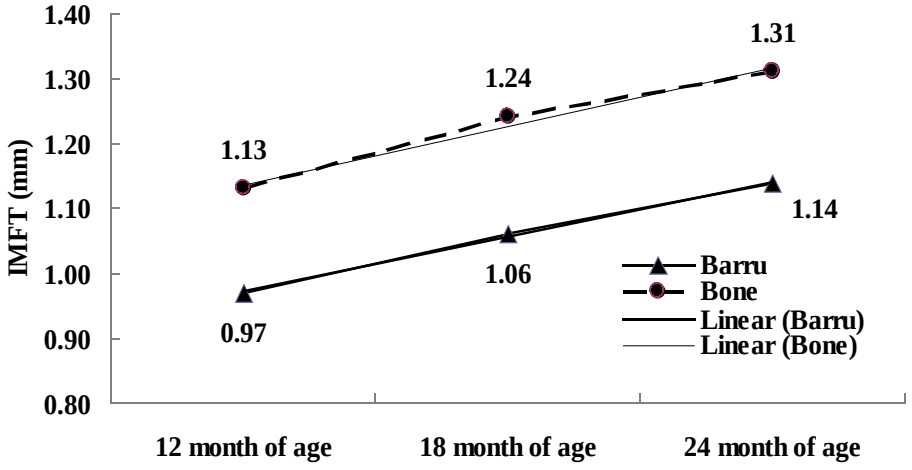

Figure 7. The Growth of IMFT of the Bali Bulls at Barru and Bone District

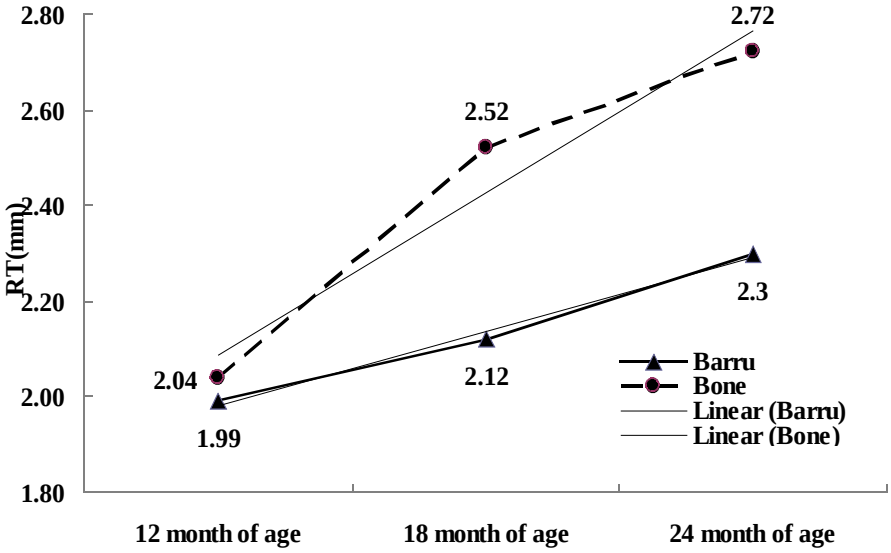

Figure 8. The Growth of RT of the Bali Bulls at Barru and Bone District

of 12 and 18 months of ages of Angus steers were 0.33 mm and 1.35 mm, respectively. The SFT of yearling Simmental bulls were thicker (4.06 mm) in Crews *et al*. (2003). Those subcutaneous fat differences are related with genetic factor (breed, ancestors), the feeding program, and the grass and concentrate quality which are highly influencing to the fat deposition. Bulls that are not castrated will produce testosterone and have a longer growth curve, causing them to deposit muscle longer and deposit fat at a later stage in life (Stelzleni, *et al*., 2003). That results shows that the carcass quality of Bali bulls at the 12, 18 and 24 months of age could not be the basis of the selection of sire candidate, yet.

The growth of carcass quality of Bali bulls at Bone district is better than those at Barru district. This condition is related to feeding quality factor and the differences of rearing management system in both locations. Sometimes the Bali bulls, which were reared under semi intensive system at Bone district, were given the additional feeding supplement such as rice bran. On the other hand, the rearing system of Bali bulls at Barru district were done under extensive system such as the bulls were grazed to the hills that far away from residential areas that are relatively without any owner supervision. The feed type consumed of Bali bulls at Barru district is a grass field, waste of corn plantations and waste of peanut plantations. That condition cause the feeding quality and quantity can not be measured and observed well. On the other hand, the pedigree of the bulls of Bali cattle at both locations can not be traced accurately because of their parents or grandparents were bought from outside of South Sulawesi.

The low carcass quality of Bali bulls until the age of 24 months can be caused by environmental factor such as the low of feeding quality or the management of rearing system that are not well structured to support the optimal growth of cattle. Beside that the genetic factor is still require for further research because the

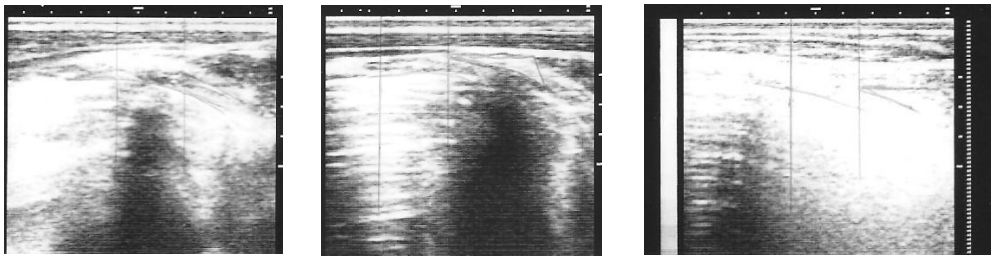

Figure 9. The SFT, IMFT and RT of the Bali Bulls at the 12, 18, 24 Month of Age

genetic factor can be a differentiating factor for the development of carcass quality, especially marbling. The extent animals lay down muscle or fat is dependent on management and feeding strategies, but has also a genetic background (Ericksson, 2003).

The 24 months of age of the Bali bulls is already a mature period but the bulls still tend to grow. This condition make the fat deposition is not optimal. Beside fat deposition, marbling will affect the size of body dimensions and also carcass composition. The marblings make the good taste and good flavour of meat. The Japanese Black and Brown cattle also have the ability to begin to fat deposit under the skin (subcutaneous fat and form the marbling) which can be measured using ultrasound at the relatively early age of 12 months (Sri Rachma, 2001) while those of the American or Europe breed of cattle were later at around 18-30 months of age. This condition is related to the slaughtering age and meat quality factor. The American and Europe breed of cattle were slaughtered younger (around the 18 months of age) to get a more tender meat although the marbling growth does not reach the peak performance yet. The Japanese cattle were slaughtered relatively late (around the 24 months of age) to get more optimal of marbling growth that will make better of meat quality (Sri Rachma, 2001). In the case of Bali cattle, the slaughtering was done after three years of age but the Bali cattle were not slaughtered based on the meat quality or quantity. The majority of slaughtering reason is the economical difficulties of the farmer or based on the prices.

CONCLUSION

The growth of carcass (MLTA, SFT, IMFT, RT and BMS) of Bali cattle at the 12, 18, 24 months of age did not reaching the peak performance yet. The selection process of bulls Bali cattle based on the estimated of carcass traits at the 12, 18 and 24 months of age could not be done yet. The selection process of the sire candidate is better to be done since 4 years of age.

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