



Performance Analysis in Cattle Before the use of Anabolics as Growth Promoters

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Abstract

The administration of anabolics for the performance of bovine animals was 1 ml per 90 kg of body weight every 30 days. The block design evaluated the number of animals by administering Anabolic ST (A) and Boldemax (B). For the first block, group A was the animals with an approximate weight of 354 (+41) kg, group A was 18 heads and group B was 24 heads, and each animal was weighed for 41 days. For block two, animals weighing approximately 479.5 (+ 26.9) kg. Group A consisted of 23 head and group B consisted of 23 head and each animal was weighed for 39 days. For block three with animals weighing approximately 524 (+6.4) kg. Where group A will have 27 head and group B 13 head and each animal will be weighed for 55 days. The statistical analyses of the results were analyzed using the student's t test for the following parameters: feed intake, mean total weight gain, feed conversion. The ANOVA test was performed to determine the statistical significance between means, and a Tukey test ($P < 0.05$). There was a statistical difference between treatments ($P < 0.05$) of the three experimental blocks with the anabolic Boldemax in the total mean gain in kg (160, 237, 68.6 versus 137, 187, 61.4); Feed conversion kg. (3.92, 6.34, 1.76, 1.8 versus 3.96, 6.2, 1.72), of the blocks that consumed this anabolic. It is concluded that there is a significant difference between GMTP of animals with a confidence level of 95%. that the anabolic Boldemax was applied compared to the Anabolic ST and there is a better feed efficiency due to the cost when administering Boldemax in the treatments evaluated.

Keywords: Feed Efficiency; Beef Cattle; Anabolics; Boldemax®

Introduction

The efficiency of the feeds supplied to animals for the production of meat in any species has been constantly present, although great advances have been made in different substances, molecules, etc., there is still a long way to go, as more and more production is needed with less feed supplied. This would not make sense without an ever-increasing demand for food, such as the demand for beef at the national and international levels.

In 2015, national production amounted to 1,762 tons, while total imports amounted to 127 tons. 172 tons were exported and apparent domestic consumption reached a total of 1,717 tons. Already for estimated figures for 2022, there is talk of a production

of 2,030 tons, this represents a growth of 1.78% per year, while imports went to 131 tons in the same period, thus growing by approximately 0.39% per year. In exports, for 2022, it is estimated that they will reach 253 tons, this represents a growth of approximately 5%. Speaking of national consumption, it is estimated that it will reach 1,908 tons, this represents a growth of 1.33%.

These growths mentioned above are in a scenario of low exports, since for 2021, 290 tons were exported, and added to the fact that, at the international level, production decreases due to the coronavirus and the war in Ukraine, it is known that it may be scarce and increase the prices of basic products such as beef.

As can be seen, national and international demand is increasing, prices are on the rise, because from being at a moderate growth before the pandemic (+3% per year) today, at least, they have grown 7.28% per year [14], which was the annual general inflation. This is a stimulus to the producer since, when the price increases, the willingness to produce more increases, together with obtaining greater efficiency in production, it would represent greater profits.

This generates an increasing push in the search for an anabolic or a growth promoter stimulant, prebiotic, that helps improve meat quality, greater daily weight gain (GDP), higher dry matter conversion (DMS) and feed conversion (CA). Anabolics are an option as they improve meat production, specifically growth rate and feed convertibility [5]. In addition, anabolics increase muscle mass, improve body fat distribution, and increase appetite [24].

In the present work, a comparison is made between two anabolics, Anabolic ST and Boldemax to evaluate the efficiency in productivity indicators, such as the comparison of mean total weight gain, daily weight gain (GDP), feed conversion (CA), economic efficiency through utility and the comparison of all the previous indicators in different groups taking weight and age as references. The application of Anabolic ST in cows, heifers and bulls generates higher yields in the indicators of total average weight gain and GDP, than with the application of the Boldemax product in the same groups of cattle. In addition, taking into account the above, it generates greater profits since it has a lower feed consumption and higher GDP.

Material and Methods

The work is divided into 4 parts, the first presents the background in the application of other anabolics in addition to the existing legislation in Mexico on the application of anabolics, referring to the application of the active compounds of Anabolic ST and Boldemax.

Introduction

For the second part, anabolics and their characteristics are presented. The third part presents the methodological development where the variables are addressed and the tests are carried out, exposing the tools to be used. For the fourth part, the results and conclusions are presented.

History of steroid use

Anabolic steroids were discovered in the 1930s to treat muscle growth in skeletal laboratory animals. The problem was that the testicles did not produce enough testosterone for the normal development and functioning of the animals. Testosterone-derived steroids were then created that try to chemically decrease androgenic effects and help increase anabolic activity [10].

Anabolics are compounds capable of retaining nitrogen, which is a necessary element for protein synthesis and helps generate the formation of red blood cells and retain calcium and phosphorus [16].

Anabolics that are growth promoters are synthetic substances that are related to sex hormones. The term anabolic refers to the effects of muscle growth to which it is focused [5]. In addition, because they are artificial, they are more active and persistent than natural hormones, as they are metabolized more slowly than the previous ones.

There are different types of anabolic synthetic steroids [5], which are grouped by stilbenics (diethylstilbestrol and dienestrol) which are prohibited, and non-stilbenic steroids, the best known being zeranol, trenbolone, menengestrol, boldenone which is a derivative of testosterone and Stanozolol which is a derivative of dihydrotestosterone.

Several anabolics have demonstrated the efficiency of their application in cattle, as they have generated, as mentioned above, an improvement in performance indicators in meat production (22; 13; 13 and 1).

It is important to note that the application of anabolics is a widely used practice in Mexico, but there is a lack of a large number of publications that contribute to the discussion of productivity in the application.

For the first group, which are the control group, there were 15 animals, 5 for each size (small, medium and large), and another group where 15 animals were applied to which Zeranol was applied to different sizes of bulls (5 for each size).

The statistics to be evaluated were initial weight, final weight, weight gain and profitability.

The design was carried out for random blocks by analyzing weights and differences of variance using Duncan's multiple rank method.

The results obtained are that, for the average weight at 45 and 90 days, the explanation for weight gain is due to 85.21 and 87.43 % (respectively) to the size of the animals and the application of the anabolic. In addition, for Duncan's multi-range test, the average weight at 45 and 90 days was higher in which Zeranol was applied than in the controls. It was also found that the large bulls were the ones that obtained the highest average weight compared to the other sizes.

Anabolics were used in the development and growth of cross-bred bulls in fattening, the age of the animals was between six to eight months of age, obtaining 271.67 grams per day, to which Boldenone was applied [1,13].

For the application of the anabolic Boldenone [13] a study was carried out for the application of four anabolics: Zeranol, Estradiol plus Trenbolone and Boldenone, against controls in crossed bulls. The test lasted 4 months and the methodology of completely randomized blocks was applied. It was found that only the anabolics Zeranol and Estradiol had significant differences at 5%, which presented better final weights, better feed conversion (12.29 and 12.92) as well as weight gain 40 and 36 kg. In addition, a cost per kilogram of weight gain of \$1.11 and \$1.17 respectively was obtained.

In the above, no significant difference was found between the control group and those to which Boldenone was applied.

There are no data on the application of Stanozolol in bovine animals and the effects of this anabolic. Therefore, it is necessary to generate more scientific works for the evaluation of the application and benefits of anabolics in the production of meat in cattle.

Legislation

The legislation established for the use, withdrawal, safety of implementation and supply of food and chemical substances, in this case anabolics, are established in the Official Mexican Standard NOM-004-ZOO-1994 in which the maximum possible toxic residues in fat, liver, muscle and kidney in cattle are established.

The use of anabolics such as Stanozolol is not regulated, in itself, there is no standard which mentions what the limits of the anabolic supply are. What, if mentioned in the above standard, is to follow the manufacturer's instructions for the application of the anabolic substance. In addition, the substance is not prohibited by current regulations [19], but it is important to mention that there are maximum residue limits in muscles in cattle which must be met (0.00008 mg/kg). Therefore, the supply of Stanozolol as a growth promoter is safe if the manufacturer's instructions are followed.

Experimental design

Three comparison blocks are taken into account for the test, the first block will be evaluated on cows with an average weight of 354 (+-41) kg. In the second block are cows with an average weight of 479.5 (+- 26.9), in the third group they will be bulls with an average weight of 524 (+-6.4) kg. The number of animals in each block will be divided into groups by the administration of Anabolic ST (A) and Boldemax (B). For the first block, group A will be 18 heads

and for group B 24 heads. For block two, group A consists of 23 heads and group B 23 heads. For block three, group A will have 27 heads and group B 13 heads.

For block 1, two applications of anabolics A and B are made, while the other blocks are only applied once.

The time frame to which the blocks will be taken is as follows

The first block is taken to 41 and then to 105 days of fattening. The second block is taken up to 44 days of fattening, and, finally, the third block is taken up to 55 days of fattening.

Determination of production parameters

The data were adjusted to make them comparable, weights were weighted to the days of fattening, since some groups were weighed in different temporalities. In block 2, the weights were obtained at a temporality of 39 and 44 days from groups A and B respectively, so both weights were adjusted to 39 days.

For block 3, weigh-ins were performed on 60 and 55 days in groups A and B respectively. They were then adjusted to 55 days.

The indicators were estimated using the following formulas.

$$\text{Daily Weight Gain (GDP)} = \frac{\text{Peso final} - \text{Peso inicial}}{\text{Dias transcurridos}} \quad \text{----- (1)}$$

$$\text{Feed Conversion (C)} = \frac{\text{CMS}}{\text{GDP}} \quad \text{----- (2)}$$

$$\text{Daily Dry Matter Intake (DMS)} = \frac{\text{Materia seca ofrecida restante} - \text{Materia seca ofrecida inicial}}{\text{animales por corral}} \quad \text{----- (3)}$$

$$\text{Average Total Weight Gain (GMTP)} = \text{Peso medio al final del estudio} - \text{Peso medio al inicio del estudio} \quad \text{----- (4)}$$

Description of anabolics

The anabolics to try are Boldemax which contains boldenone, which is a semi-synthetic anabolic derived from testosterone, which includes modifications of chemical radicals attached to the steroid molecule having the effect of anabolic increase and androgenic reduction [8].

Action properties

Increases muscle mass through nitrogen retention.

"It is myotropic because it acts in the cytoplasm of the muscle cell, promotes the release of the enzyme alpha reductase in the nucleus, allowing RNA to take advantage of amino acids and proteins (nitrogen) from the diet to transform them into muscle tissue" [8].

- Increases the retention of calcium, phosphorus, potassium and chlorides,
- It stimulates the appetite of animals.
- It stimulates erythropoiesis in organs and in the kidneys.

Suitable for

- Anemic bovine animals
- Animals with problems of osteomalacia, osteoporosis, leukopenia.
- Diseases of constant weakness which produce weight loss, convalescent states, rickets, fractures and post-surgical stress.
- Drastic temperature changes
- Any other situation in which protein synthesis needs to be promoted [8].

The dose for bovine animals is 1 ml per 90 kg of body weight every 30 days or at the discretion of the veterinarian.

On the other hand, Anabolic ST which is made from micronized Stanozolol, is part of the anabolic steroids. It is a synthetic steroid structurally related to testosterone. It is characterized by decreasing the androgenic effect [3].

Action properties

- It stimulates protein synthesis and promotes tissue reconstruction.
- It promotes the transport of "long-chain fatty acids across the mitochondrial membrane into the matrix, thus allowing lipids to be used for energy production" [17].
- It stimulates metabolism, increases nitrogen and mineral retention.
- Another important improvement unlike other products is that you have an improvement in the animal's condition without exciting the nervous system

Directions

- Animals that have been exposed to diseases or convalescents in which it has caused weight loss or debilitation.
- Animals recovering from operations, burns, osteoporosis.
- Recommended for animals with anorexia, chronic diseases, cachexia, trauma or old age
- Depressed animals caused by disease.
- Animals with low weights.

The recommended dose for use in bovine animals is 1 ml per 180 to 200 kg body weight every 2 to 4 weeks.

Statistical analysis of results

Descriptive data analysis was used for the total mean weight gain for all groups in the different blocks. This was projected onto graphs for better visualization.

The next step was to perform upper-tail hypothesis tests for small samples using the student's t-distribution. This was applied to both the total average weight gain and the daily weight gain for each of the blocks. The main objective was to show a statistically significant difference between groups by blocks.

Finally, an ANOVA test was carried out to find out if there was at least an average, both of weights and of daily weight gain, that was different from the others, if statistical significance was obtained, then the Tukey test was applied, otherwise the test did not make sense to apply the Tukey test.

Results and Discussion

As mentioned above, in methods and techniques, Mean Total Weight Gain (GMTP) of each block were tested to observe if there is a significant difference by using anabolics. Hormonal compounds derived from steroids, with anabolic effects used as natural and synthetic compounds are intended to stimulate metabolic functions and protein synthesis, particularly with the increase of muscle mass in meat animals, and body growth with a consequent improvement in production efficiency [7,18]. The significant differences shown in block 1 for a period of 41 days were that the group to which Boldemax was applied obtained a higher GMTP than the group to which Anabolic ST was applied, the difference in GMTP per animal from B to A was 22.8 kg per animal. In addition, a significant difference in profit of 245.89 pesos per animal was obtained. Similarly, in block 1 at 105 days, a significant difference was shown in GMTP between the group to which Boldemax was applied and the group that was applied Anabolic ST, of 50.5 kg, which represented a higher utility of 274.36 pesos per animal. Figure 1 shows the 41-day fattening GMTP of block 1.

It was found that there is a significant difference between GMTP of cows with a confidence level of 95%. Therefore, it can be said that the GMTP of cows that were applied the anabolic Boldemax is higher than GMTP of cows that were applied Anabolic ST. Administering these anabolics can promote changes in the body that have a positive impact on animal production and meat quality, such as: improving appetite and voluntary feed consumption with a significant improvement in feed conversion and growth speed, which is manifested in an increase in muscle mass, with changes in the deposition and distribution of body fat [11; 25].

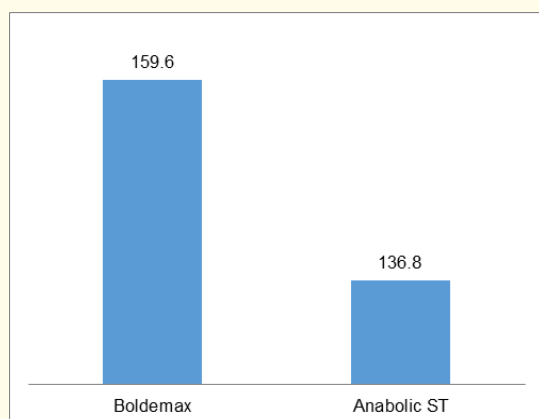


Figure 1: Average Total Weight Gain per anabolic. After 41 days of fattening.

Also for this same block (1), with a temporality of 105 days, the GMTP is shown (Figure 2). It was found that the GMTP of cows that were applied Boldemax is higher than the GMTP of cows that were applied Anabolic ST, with a confidence level of 95%.

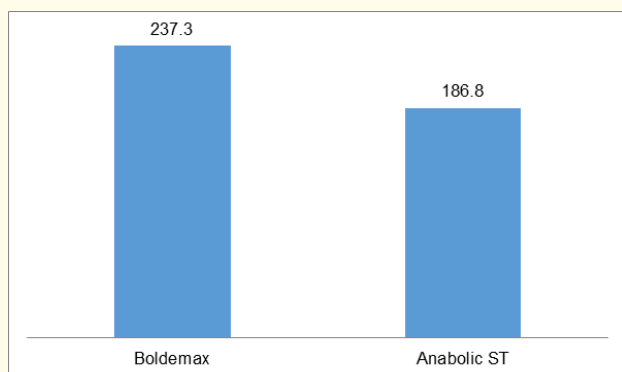


Figure 2: Average Total Weight Gain per anabolic. At 105 days of fattening

In this same block [1], for a time frame of 41 days, the GDP is shown with a higher value in those cows that were given the anabolic Boldemax than in the Anabolic ST, with almost 300 grams more (Figure 3). Two mechanisms have been identified; By assuming that drugs with an anabolic effect can act indirectly, by modifying the functionality of the animal’s endocrine system, and directly by regulating the protein synthesis and degradation of muscle cells, causing an increase in nitrogen retention and protein deposition at the muscle level, improving daily weight gain due to the effect of the administration of anabolics for the benefit of promoting less time of the patient. development and fattening of beef cattle, including breed, sex, health status, climate, etc. (4; 9).

For the statistical significance test, the GDP of this block (1), at 41 days, it was obtained that the anabolic Boldemax is signifi-

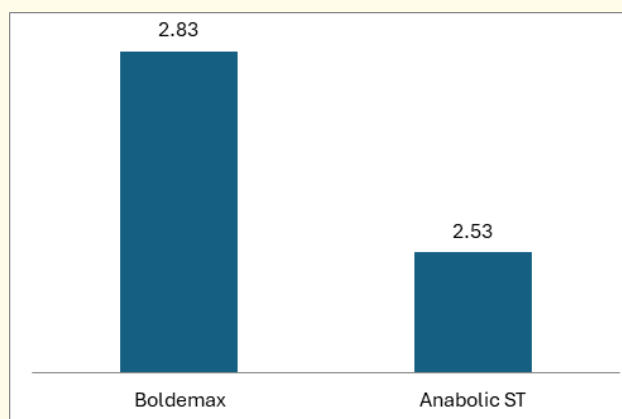


Figure 3: Daily Weight Gain by anabolic. After 41 days of fattening.

cantly higher than the Anabolic ST with a confidence level of 95%. The action of anabolics on the endocrine system and the organs of the reproductive system results in glandular changes in the pituitary, thyroid and adrenal glands of the treated animals, in which an increase in body weight is also appreciated. Weight gain may be generated by increased pituitary glandular activity, reflected by increased blood levels of growth hormone (20;12). Anabolic agents have been considered to inhibit the concentration of gonadotropins, by increasing TSH secretion, modifying weight gain, and building muscle from fat. Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) concentrations are significantly decreased by estrogen-like compounds derived from resolic acid lactones, due to an inhibition in gonadotropin synthesis; therefore, there is atrophy of the ovaries, testes and epididymis, due to low levels of luteinizing hormone (LH), in non-castrated male animals treated, for example, with zeranol; whereas within the function of the interstitial cells of the testes, which are dependent and stimulating to LH, a decrease in testicular size is likely to occur, due to the fact that zeranol occupies testosterone receptors in the hypothalamic regions, and is therefore able to inhibit the normal feedback of luteinizing hormone (2; 11; 23).

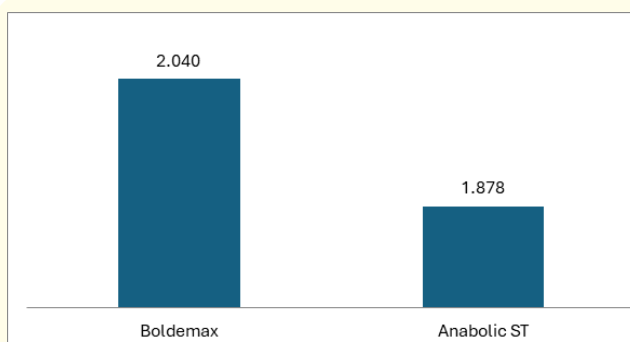


Figure 4: Daily Weight Gain by anabolic. A 105 days of fattening.

In the same sense, at 105 days, an absolute difference of 160 grams was obtained (Figure 4), which was observed that there is no significant difference between the application of anabolics for this block (1), with a confidence level of 95%.

In order to improve food safety, regardless of the feed efficiency provided by using anabolics in the fattening of beef cattle for their economic benefit, it is important to point out that the active participation of the general population and public bodies is required within a framework of social collaboration, each fulfilling the functions and activities that allow improving the quality and food safety of products and by-products of animal origin. As well as biological, chemical, pharmaceutical and food products, for use in animals or consumption by them, which must have an

animal health certificate, in order to verify compliance with official animal health standards. Likewise, verify the animal health characteristics and specifications so that all animal owners immunize them against the communicable diseases prevalent in the area, for each animal species; as well as verifying that they provide adequate feeding, hygiene, mobilization and shelter of the animals necessary in animal welfare to ensure their health (15; 21).

As observed in this 41-day block, feed conversion and profits were obtained, which are shown in table 1 below. It is important to mention that statistical significance was obtained for the difference in GMTP and in the difference in daily weight gain, therefore, the difference in the usefulness of the application of the anabolic Boldemax with respect to the Anabolic ST is greater at 245.89 pesos.

Indicators	Boldemax	Anabolic ST	Difference
Average Total Weight Gain Per Animal	159.6	136.8	22.8
Feed Conversion:	3.919	3.962	0.17
Average Serving Price:	\$3.93	\$3.93	\$ -
Cost per Kg produced:	\$21.22	\$20.55	\$0.66
Average Profit Per Animal	\$2,358.95	\$2,113.06	\$245.89

Table 1: Distribution of productivity indicators by anabolic and their difference. 41 days.

In the same sense and for the same block at 105 days, it should be noted that there is statistical significance for GMTP, a higher average utility per animal was shown in the application of Boldemax than in Anabolic ST (Table 2). The difference was 274.36 pesos per animal.

For block 2; where anabolic was applied in cows and fattened for a time of 39 days, the mean total weight gain (GMTP) was obtained, as shown in the following figure [5].

Indicators	Boldemax	Anabolic ST	Difference
Average Total Weight Gain Per Animal	237.3	186.8	50.5
Feed Conversion:	6.337	6.170	0.17
Average Serving Price:	\$4.10	\$4.10	\$ -
Cost per kg produced:	\$30.57	\$30.57	\$0.80
Average Profit Per Animal	\$1,289.28	\$1,014.92	\$274.36

Table 2: Distribution of productivity indicators by anabolic and their difference. To 105 days.

It is interesting to mention [13], anabolics were applied and the animals were fattened in a period of 4 months, a feed conversion of 12.29 and 12.92 was obtained for the application of Zeranol and Estradiol, compared to the present study a 3-month feed conversion of 6.3 and 6.1, Boldenone and Stanozolol, which are shown to be much lower than in the previous study. It should be noted that it is not the same temporality, but it can give an idea of where the CA would tend.

The application of the anabolic Zeranol [11] in bulls of different sizes (small, medium and large). They were given Zeranol only once and were taken to a temporality of 45 and 90 days. There were 5 heads per treatment and size of the bull. The weights of the small bulls were 255 +- 13.2 kg, medium 325 +- 4 kg., and large 405 +- 49 kg.

On the other hand, the average cost per kilogram of weight gain is 1.11 and 1.17 dollars, at the exchange rate of 21 pesos, 23.31 and 24.57 pesos are obtained, which, compared to the present study, are cheaper since the cost per kilogram of weight gain was 30.5, which is well above the projected costs of the study.

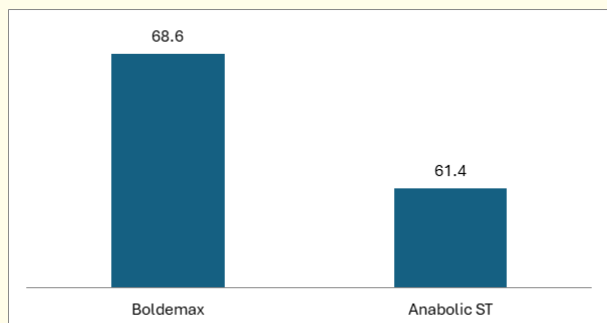


Figure 5: Average Total Weight Gain per anabolic. After 39 days of fattening.

The GMTP of the cows that were applied Boldemax was higher than that that applied Anabolic ST, in absolute terms, but when testing statistical significance, this difference was rejected, so it was not shown that the average application of Boldemax, for this block, was higher than the average application of the anabolic Anabolic ST.

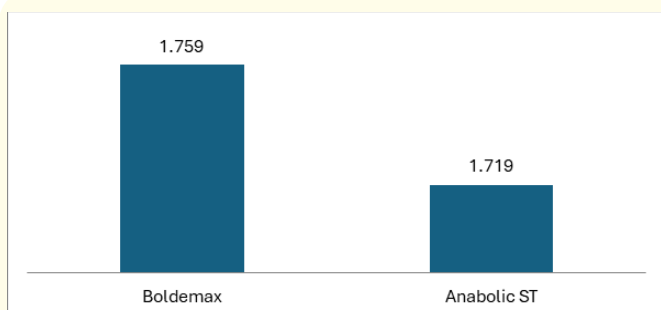


Figure 6: Daily Weight Gain by anabolic. 39 days of fattening.

Like the previous test, in absolute values the GDP of the anabolic Boldemax is higher than that of the Anabolic ST, but when statistical significance was applied, it was rejected that they were different. So there is no difference between GDP indicators for anabolics.

In block 3; As seen in the methodology, bulls fattened in a period of 55 days were taken into account. GMTP is shown in the figure below.

It can be seen at a glance that the GMTP is higher in bulls that were given Boldemax than those that were given Anabolic ST. Un-

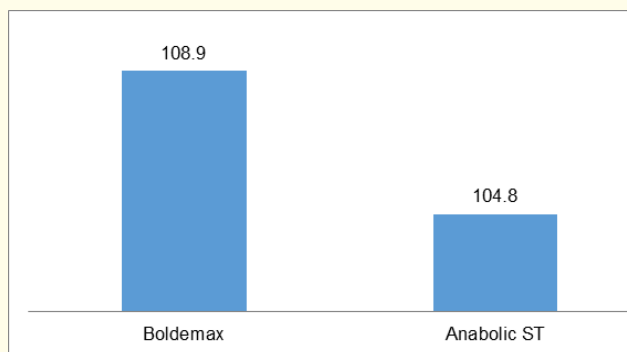


Figure 7: Average Total Weight Gain per anabolic. 55 days of fattening

der the statistical significance test, it was not shown that the GMTP of bulls that were applied Boldemax was higher than the GMTP of bulls that were applied Anabolic ST. Finally, it is intended to have the necessary bases to guarantee the safety of food meat products. The continuous improvement of animal performance and the benefit of an industry within the global economic framework and aims to ensure the quality and safety of food of animal origin [25].

Official standards are adequate, considering advances based on scientific research and available technology, for the use of information whose technical support is reliable for the producer and the final consumer.

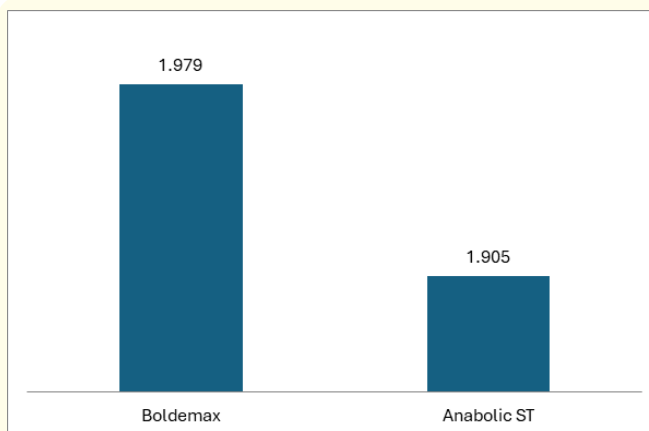


Figure 8: Daily Weight Gain by anabolic. At 55 days of fattening.

In the study carried out by researchers from Spain, in a group of Branghus steers of 720 +- 15 days of age and weighing 265 +- 5 kg. Two types of anabolics, Zeranol and Stanozolol, were applied through implants, and a control group was also used. It was found that the average daily weight gain showed a significant difference (p-value 0.01) with respect to the controls during the 60 days of treatment, while there was no significant difference between the groups to which the anabolic was applied [22].

Conclusion

According to the results obtained under the conditions of this study, the anabolic Boldemax showed a higher value of GMTP, Feed Conversion and Feed Efficiency, than in animals that were applied Anabolic ST.

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