SciMedCentral

Journal of Veterinary Medicine and Research

Review Article

Using Morphometric Variables in Evaluations of Body of Fish Yields

Viviane De Oliveira Felizardo[1], Carlos Cicinato Vieira Melo[2], Marco Aurélio Dessimoni Dias[2], Roberson Machado Pimentel[2], Rilke Tadeu Fonseca De Freitas[1] and Luis David Solis Murgas[2]

[1]*Department of Veterinary Medicine, Federal University of Lavras, Brazil*
[2]*Department of Animal Science, Federal University of Lavras, Brazil*

***Corresponding author**
Viviane De Oliveira Felizardo, Department of Veterinary Medicine, Federal University of Lavras - UFLA, Mailbox: 3037, Lavras, Minas Gerais, 37200-000, Brazil. Tel: 553-591-115-177; Fax: 55 35 3829 2735; Email: viviofbio@yahoo.com.br

Submitted: 03 August 2015

Accepted: 18 September 2015

Published: 21 September 2015

ISSN: 2378-931X

Keywords

- Biometrics
- Breeding programs
- Carcass
- Estimate

Abstract

The study of the use of morphometric variables in the evaluation of body income in fish is of great importance from an economic point of view, because through them, can make an estimation of productivity, both for the farmer and for the fish processing industry; or even serve as selection criteria in breeding programs. The fish carcass quality is an essential factor for defining the preparation processes of products and types of fish cuts. Over the years it was developed several methods to evaluate in vivo animal goals to help the breeding and commercially classify carcasses. The housing assessment work, are disabled by the lack of standardization of the terms used and due to the divergence of body regions in which measurements are obtained. These facts undermine the comparison of data in the same species and in different species. Some morphometric measurements may exhibit a linear relationship with the body weight and the yield, indicating that there is proportionality between these parameters during growth. In breeding programs, knowledge of the correlation between characters is important when you want to do simultaneous selection or when a character of interest has a low heritability, problems of difficulty of measurement or identification. The correlation unfolding is dependent on the number of characters studied, which is generally established by prior knowledge the investigator as to their importance to possible inter-relationships expressed in path diagrams.

INTRODUCTION

The increase in world population and the increasing demand for high quality protein sources lead sectors of animal production to seek greater productive and economic efficiency [1].

Studies on morphometric variables and body yields in fish is of great importance from an economic point of view, because through them, can make an estimation of productivity, both for the farmer and for the fish processing industry [2].

The industrialization of fish a major problem to be solved is the lack of standardization in marketed products [3]. Factors such as anatomical shape, head size, weight offal and waste and skill of the operator, can influence the cuts and revenues of edible parts obtained [2,4], being decisive in the development methods and techniques aimed at processing of fish [3,5].

For the industry, fish carcass quality is essential in the definition of preparation techniques and standardization of products [6]. One of the aspects to be considered in this sense, are the morphometric variables of the fish, which can suggest the best way of getting cuts, increasing the income of the edible parts or even serve as selection criteria in breeding programs and encourage the production of potential species [7,8].

The purpose of this article is to review the literature on the influence of biometric variables of fish used for evaluation of body yields.

Fish processing

According to [9], the service of the fish, also known as clean or cleaner trunk body is the body without head, fins, skin and viscera ready for consumption and / or industrialization and from this can- if you still get the steak. For most fish processing plants, is the most commercialized form the fillet and, to a lesser extent, the entire gutted fish or as main trunk. Thus, information is needed on variables that influence in the body of the fish yields.

According to [10], the format of the final product to the consumer, whole gutted, head, trunk clean, fillet with or without skin, put in, among others, may interfere with the acceptability of it. Depending on the size of the fish peculiarities and

characteristics of the end product must bear practice to different cleaning techniques and cuts.

The use of mechanical separation techniques of fish meat has been one of the alternatives in the fishing industry for the diversification of its products. Thus, a product that has no pimples and/or miocéptos Y-shaped characteristic that attracts many consumers. Furthermore, it is a food easily digestible and source of protein, minerals, especially calcium and phosphorus, vitamins A, D and B complex [11,12].

The seafood industry still does not value the carcass characteristics, and pay only for body weight. However, as in other species used in animal production (poultry, pork and beef), the tendency is for fish with better carcass characteristics are valued for quality of product offered.

Yield Processing

Studies on fish body yields are of great importance from the point of view of economic production and, therefore, through them can make an estimate of the productivity, both for the farmer and for the fish processing industry [4].

For industry, the fish carcass quality is an essential factor for defining the preparation processes of products and types of cuts. The yield of the fillet, for example, besides the efficiency of filetadoras machines or manual dexterity of the workers, and filleting method depends on some features intrinsic to the raw material as the anatomical shape of the body, head size, weight waste (bowels, skin and fins) [13,5], as well as genetic and environmental differences [14].

The fillet yield varies among species and within species, possibly due to the lack of a standard system in the methodologies of research in this area [15]. According to [16], because there is no standard filleting, there is disagreement about the best method to be employed, that is, which method provides the greatest fillet yield, operational ease and less processing time. Studying six filleting methods used in tilapia processing units in the Nile and fishing, the author concluded that the method by which withdraws the whole fish skin and then remove the fillet provides the best fillet yield results, gross skin and clean and a lower percentage of filleting waste.

Regarding the carcass yield, there is no standardization for their production, there is a disparity in respect of the terms used [4,5].Adopted the carcass expression or clean trunk, to express the useful part of the fish, ready for consumption and / or industrialization, i.e. the trunk without head, viscera, fins, but with the spine and the skin without scales. Already [17] considered the trunk as the whole fish, gutted and head only, and [4] reported to clean trunk as the trunk gutted, head, skin and fins [18]. Referred to the housing as the trunk without head, guts and skin, while [19] define it as whole fish gutted.

Through this percentage of clean or housing body, one can compare the species, assess critical factors and see the industrialization potential. However, depending on the species to be imaged, the most important is to know the fillet yield, which is a product ready for industrialization [5].

[5] Have securities of edible parts of 29 marine species and 13 river species, analyzed by several Brazilian researchers. According to him, the body clean (no head, guts and fins) is on average 62.6% of the weight of marine fish and freshwater. As for the fillet with skin yield marine and freshwater species is between 32.8 and 59.8%, averaging 50.5%. With the removal of the skin for the preparation of more elaborate product reduces the yield to 43.0%, whereas the skin amounts to an average of 7.5% by weight of teleost fish.

Body yields assessment in live animals

Attempts to estimate the body production animals began with studies by Lawes and Gilbert in 1860. Over the years were developed several methods to evaluate in vivo animal with aims to assist the breeding and commercially classify carcasses [20].

Different research using body assessment methodologies are routinely used in animal production and can highlight the measurement by means of weighing, biometrics specific locations, such as eye-to-back area, and ultrassonografia techniques that preserve live animals [1].

Morphometric measurements, or conformation, contribute to the description of the fish's body shape, which varies according to the characteristics of each kind, and they can influence the body weight and the yields [21,22]. As [5], this is due to the differential ability of muscle mass accumulation in certain animal body points during their growth, which characterizes its shape and influence yields.

The techniques that are based on images such as computed tomography and magnetic resonance still has its restricted use in animal production at high cost. Analysis of the body content of the fish by ultrasound has been used in research worldwide due to its non-invasive, simple, accurate and computerized character [23].

The use of linear correlation coefficients between characters have been obtained and used as indirect selection strategy in animal production. If the character under selection show high heritability and correlation coefficient is high with body yields, indirect selection will be efficient in identifying superior genotypes. Some of the advantages of using techniques of indirect determination to obtain information on the characteristics of productive interest is the possibility of the measures being carried out in live animals.

Influence of morphometric measurements in body yields

According to [14], studies that use metric measurements as selection criteria are justified when there are high correlations with these productive measures of added commercial value, such as weight and yield carcass and fillet.

According [24], a major advantage of utilizationde body measurements to obtain information about the characteristics of productive interest is the possibility that these measures are carried out in live animals, which would allow the use of some of them as selection criteria. If the correlations of these measures with the characteristic of interest are high, it could be achieved, for example, answers correlated with the fillet yield for indirect selection.

The housing assessment work, according to [25], they are handicapped by the lack of standardization of the terms used and due to the divergence of body regions in which measurements are obtained. These facts undermine the comparison of data in the same species and in different species.

[24] Observed that some morphometric measurements may show a linear relationship with the weight and the fillet yield, indicating that there is proportionality between these parameters during growth.

[26] Found that the width and the pattern length can be used as selection criteria for determining the weight and fillet yield Nile tilapia. There ease of selection of those characteristics in relation to the fillet weight and yield is due to its ease of metering, since they are simple measures to be taken when working with a large population.

According [27] body height was considered the most important measure for determining the slaughter weight and fillet of tilapia weight, indicating that meat production is related to the height of the fish.

The importance of time was also observed by [28], which found that the heights taken in the first ray of pectoral and dorsal fin as well as the standard length, were the measures best suited to the carcass evaluation.

[29] Evaluated the relationship between heights and widths shown to be important in the characterization of the fillet forming and concluded that the increase in these relationships contributes to a more robust body shape.

According to [5], the fillet yield depends on several factors too, not the fish morphology, among them the efficiency of fillet machines, the skill of the workers during filletingmanual, skin thickness of the fish, which varies according to species of fish, the anatomic shape of the body and varies between fish species, can vary according to sex and age and the technique employed decapitation. Together, these factors can contribute to increasedloss of muscle tissue, as the stem is being handled in processing.

According [30], comparative studies of the fillet yield in different filleting process produced a range of 10 to 20%, with a variation in the mechanical separation process, indicating that the study of the performance characteristics can be affected by processing techniques in which the income was obtained.

Association between variables

In breeding programs, knowledge of the correlation between characters is important when you want to do simultaneous selection or when a character of interest has a low heritability, problems of difficulty of measurement or identification. In this case, to select another character of high heritability, easy measurement and identification and which has a high correlation with the desired character, the researcher can more rapid progress in relation to the use of direct selection [31]. [32,33] Reported that the importance of the correlation between characters in the genetic improvement lies in the fact of being able to assess how much of the change of a character can affect the other in the course of selection. The correlation of a character can take on a positive value, negative or equal to zero. However, there may be some mistakes in selection strategies of traits from the quantification of the magnitude of the correlations between them. The simple correlation allows only assess the direction and the magnitude of association between two characters without providing necessary information regarding the direct and indirect effects of a group of characters in relation to a most important dependent variable [34].

To better understand the associations between different characters, according to [35], it developed a multivariate method by geneticist Sewall Wright in 1918-1921 called path analysis. This method is the study of the direct and indirect effects of characters on a basic variable, whose estimates are obtained by regression equations in which the variables are pre-standard [36]. The success of the path analysis lies primarily in the formulation of the relationship between cause and effect variables [37]. Furthermore, the correlation unfolding is dependent on the number of characters studied, which is usually set by the investigator prior knowledge about the possible importance expressed in interrelations track diagrams [36].

CONCLUSION

The morphometric variables can be used as tools for evaluation of body yields from the fish industry and as selection criteria in breeding fish programs.

REFERENCES

1. Crepaldi DV, Teixeira EA, Faria PMC, Ribeiro LP, Saturnino HM, Melo DC, et al. A ultra-sonografia na piscicultura. Revista Brasileira de Reprodução Animal. 2006; 30: 174-181.
2. Macedo-Viégas EM, Souza MLR. Pré- processamento e conservação do pescado produzido em piscicultura. In: Cyrino JEP, Urbinati EC, Frascalossi DM, Castagnolli N. Tópicos Especiais em Piscicultura de Água Doce Tropical Intensiva. São Paulo(SP): TecArt. 2004.
3. Adames MS, Krause RA, Damasceno DZ, Pian PA, Oliveira JDS, Bombardelli RA. Rendimentos no processamento e composição centesimal da carne do Barbado. Bol. Inst. Pesca. 2014; 40: 251 – 260
4. Souza MLR, Lima S, Furuya WM, Pinto AA, Loures BTRR, Povh JA. Estudo de carcaça do bagre africano (Clarias gariepinus) em diferentes categorias de peso. Acta Scientiarum Animal Science. 1999; 21: 637-644.
5. Contreras-Guzmán E. Bioquímica de Pescados e Derivados. Jaboticabal (SP): FUNEP. 1994.
6. Santos VB, Freitas RTF, Logato PVR, Freato TA, Orfão LH, Millioti LC. Rendimento do processamento de linhagens de tilápias (Oreochromis niloticus) em função do peso corporal. Ciência e Agrotecnologia. 2007; 31: 554-562.
7. Freato TA, Freitas RTF, Santos VB, Logato PVR, Viveiros ATM. Efeito do peso de abate nos rendimentos do processamento da Piracanjuba (Brycon orbignyanus, Valenciennes, 1849). Ciência e Agrotecnologia. 2005; 29: 676-682.
8. Gomiero JSG, Ribeiro PAP, Ferreira MW, Logato PVR. Rendimento de carcaça de peixe matrinxã (Brycon cephalus) nos diferentes cortes da cabeça. Ciência Agrotecnologia. 2003; 27: 211-216.
9. Souza MLR, Marengoni NG, Pinto A A, Caçador WC. Rendimento do processamento da tilápia-do-nilo (*Oreochromis niloticus*): tipos de corte da cabeça em duas categorias de peso. Acta Scientiarum, 2000, 22: 701-706.

10. Miler KBM,Sikorski ZE, Ahumado. Anais: Tecnologia de los productos del mar: recursos, composicion nutritiva y conservacion. Zaragoza: Acríbia, 1994.

11. Kirschink PG. Avaliação da estabilidade de produtos obtidos de carne mecanicamente separada de tilápia nilótica (Oreochromis niloticus). 102 f. Tese (Doutorado em Aquicultura) - Universidade Estadual Paulista, Jaboticabal. 2007.

12. Oettererer M. Agroindústrias beneficiadoras de pescado:unidades modulares e polivalente para implantação, com enfoque nos pontos críticos, higiênicos e nutricionais. Tese (Livre Docência em Aquicultura) - Escola Superior de Agricultura "Luiz de Queiroz", Piracicaba (SP),1999.

13. Eyo AA. Carcass composition and filleting yield of ten fish species from Kainji Lake: proceedings of the FAO expert consultation on fish technology in Africa. FAO Fisheries Report. 1993; 173-175.

14. Goodman RKA. A comparison of morphometric characteristics channel catfish *Ictalurus punctatus* (Rafinesque) from seven different geographical locations. Dissertation (Master in Fisheries and Allied Aquacultures) – Auburn Universitt, Auburn, 1973.

15. Gasparino E, Campos AT, Klosovki ES, Guerreiro PK, Fulber VM, Leal DM, Sousa I. Estudos de parâmetros corporais em tilápia do Nilo (*Oreochromis niloticus*). Anais: AQÜICULTURA BRASIL, Goiânia (GO): ABRAq, 2002.

16. Souza MLR. Comparação de seis métodos de filetagem, em relação ao rendimento de filé e de subprodutos do processamento da tilápia-do-nilo (Oreochromis niloticus). Revista Brasileira de Zootecnia. 2002; 31; 1076-1084.

17. Mandelli MQ, Lona FB. Composição física em princípios imediatos da carne (filés) em *Sardinella brasiliensis* (Steidachner, 1979). Boletim do Instituto de Pesca, 1978, 5: 129-157.

18. Clement S, Lovell RT. Comparison of processing yield and nutrient composition of cultured Nile tilapia (Oreochromis niloticus) and catfish (Ictalurus punctatus). Aquaculture. 1994; 119: 229-310.

19. Pouey JF, Stingeling LA. Rendimento de carcaça e da carne do peixe-rei (*Odontesthes humensis*), na faixa de 200 a 300g. Resumos: Simpósio Brasileiro De Aquicultura. Sete Lagoas (MG), 1996.

20. Teixeira A, Delfa R. Utilização de ultra-sons na predição da composição de carcaças de caprinos e ovinos. Anais. Reunião Anual da Sociedade Brasileira de Zootecnia. João Pessoa: Sociedade Brasileira de Zootecnia, 2006.

21. Bosworth BG, Libey GS, Notter DR. Relationship among total weight, body shape, visceral components, and fillet traits in palmet to bass (Striped bass female Morones axatilis x white bass male M. chrysops) and paradise bass (Striped bass female Morones axatilis x yellow bass male M. mississippiensis). Journal of the World Aquaculture Society. 1998; 29: 40-50.

22. Christian Cibert, Yves Fermon, Dominique Vallod, François J. Meunier. Morphological screening of carp Cyprinus carpio: relationship between morphology and fillet yield. Aquatic Living Resource. 1999; 12: 1-10.

23. V Suvanich, R Ghaedian, R Chanamai, EA Decker, DJ McClements. Prediction of proximate fish composition from ultrasonic properties: catfish, cod, flounder, mackerel and salmon. Journal of Food Science. 1998; 63: 966-968.

24. Rutten MJM, Bovenhuis H, Komen H. Modeling fillet traits based on body measurements in three tilapia strains (*Oreochromis niloticus L.*). Aquaculture. 2004; 231:113-122.

25. Souza MLR. Influência das densidades de estocagem e sistemas de aeração sobre o peso e características de carcaça da tilápia do Nilo (*Oreochromis niloticus* Linnaeus, 1757). Acta Scientiarum, 1998, 20: 387-393.

26. Rutten MJM, Bovenhuis H, Komen H. Genetic parameters for fillet traits and body measurements in tilápia do Nilo (*Oreochromis niloticus L.*). Aquaculture. 2005, 246: 125-132.

27. Gonçalves TM, Almeida AJL, Oliveira HN. Avaliação de características de carcaças de tilápias do Nilo (*Oreochromis niloticus*). Anais: Reunião Anual da Sociedade Brasileira de Zootecnia. Piracicaba (SP): SBZ. 2001.

28. Freato TA. Morfometria, rendimento no processamento e inter-relações na avaliação de carcaça de Piracanjuba, *Brycon orbignyanus* (VALENCIENNES, 1849). Dissertação (Mestrado em Zootecnia) - Universidade Federal de Lavras, Lavras (MG), 2005.

29. Boscolo WR, et al. Desempenho e características de carcaça de machos revertidos de tilápia do Nilo (*Oreochromis niloticus*), linhagem tailandesa e Comum, nas fases inicial e de crescimento. Revista Brasileira de Zootecnia. 2001, 30: 1391- 1396.

30. Freitas JVF, Gurgel FFS, Machado ZL. Estudos de alguns parâmetros biométricos e da composição química, inclusive sua variação sazonal da tilápia do Nilo, *Sarotherodon niloticus (L).*do açude público "Paulo Sarasate" (Reriutaba, Ceará, Brasil), durante os anos de 1978 e 1978. Boletim Técnico do Departamento Nacional de Obras Contra Seca. Fortaleza (CE). 1979, 37: 135-151.

31. Carvalho CGP. Análise de trilha sob multicolinearidade em pimentão. Pesquisa Agropecuária Brasileira. 1999, 34: 603-613.

32. Ramalho MAP, Santos JP, Zimmermann MJO. Genética quantitativa em plantas autógamas: aplicações ao melhoramento do feijoeiro. Goiânia (GO): UFG, 1993.

33. Santos VB. Crescimento relativo e coeficientes alométricos do corpo de linhagens de tilápias does Nilo. Ciência Animal Brasileira. 2006, 7: 357-364.

34. Cruz CD. Programa GENES, versão windows: aplicativo computacional em genética e estatística. Viçosa (MG): UFV. 2001.

35. Johnson RA, Wichern DW. Applied multivariate statistical analysis. 3rded. New Jersey: Prentice-Hall. 1992.

36. Cruz CD, Carneiro PCS. Modelos biométricos aplicados ao melhoramento genético. Viçosa (MG): UFV. 2003.

37. Schuster I. Correlações, coeficientes de trilha, composição de gluteninas e qualidade do trigo para panificação. Viçosa (MG): UFV. 1996.

Cite this article

De Oliveira Felizardo V, Vieira Melo CC, Dessimoni Dias MA, Pimentel RM, De Freitas RTF, Solis Murgas LD, et al. (2015) Using Morphometric Variables in Evaluations of Body of Fish Yields. J Vet Med Res 2(4): 1032.