

Meta Analysis of Reproductive Performance of Indigenous Cattle: In Case of Ethiopia

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Abstract

The aim of this meta-analysis study is to generate information about reproductive performance of indigenous breed. The total cattle population of Ethiopia is estimated to be about 57.83 million. The literature review of the research focused on reproductive performance of indigenous breed (Fogera, Boran, Metema, Arisi, Barca, Begait, Ogaden and Horro) that found in Ethiopia. Data included in the analysis were published over a 27 years period (between 1989 and 2016). After collecting the necessary data from full length article, review articles, text book and books for analyses, preliminary editing was performed to adjusted orderly the data entered and coded using Microsoft Excel. In this study the maximum mean of AFS was $52.80 \pm .625$ months for Metema Highland Zebu (Metema H/Zebu) breeds and the minimum mean of AFS was $24.73 \pm .666$ months for Arsi breeds. Based on the present study the overall least squares means of AFS, AFC, CI, NSC and DO for Arsi breeds were $24.73 \pm .666$, $33.53 \pm .643$, $14.67 \pm .116$, $1.93 \pm .208$ and $6.30 \pm .755$ respectively. The result shows that age at first service of Arsi and Barca is shorter than other indigenous breed whereas age at first service of Metema Highland Zebu breed is longer than the other. The value of number of service per conception of Barca is smaller than others whereas the value of number of service per conception of Ogaden is higher than other indigenous breeds. The reproductive performances of Ethiopian indigenous cattle shows lower productive. Therefore, to improve these poor reproductive performances of indigenous breeds to establish genetic improvement policy, strategy and breeding program and to implement well management practices.

Keywords: cattle, indigenous, performance and reproductive

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INTRODUCTION

Livestock play important roles for production of food and represent great socio-economic and cultural values in various societies around the world. Indigenous cattle form the backbone of relevant and sustainable livestock production in most Eastern African countries because when compared with their exotic counterparts, they are better adapted to survive and reproduce under the region's harsh environments [1]

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country and still promising to rally round the economic development of the country [2]. According to the [3] report of the Central Statistical Agency the cattle population was estimated at about 57.83 million.

Despite the largest cattle population, productive and reproductive performance is very low. Productivity implies some relationship between inputs and outputs whereas production is merely an output function [4]. Feed shortage (Both in terms of quantity and quality), lack of access to land, disease prevalence, low level of management, lack of proper follow up, poor breeding management such as lack of accurate heat detection and timely insemination might have contributed considerably to long days open (Postpartum anestrous), late age at first calving, long calving interval, short lactation length and low milk production [5]. Cattle are very important livestock species in the traditional mixed crop livestock production systems of Ethiopia by providing mainly drought power, a small amount of milk, meat usually when they retire and manure.

According to [6] the cattle populations of Ethiopia are well adapted to the tropical environment producing and reproducing under stresses of high degree of temperature, high disease prevalence and low level of nutritional status. However, they are said to be low in milk and meat production.

The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity. Number of services per conception, days open still conception and calving interval are important reproductive traits which are crucial interval are important reproductive traits which are crucial for determining the profitability of dairy production. In order to improve the low productivity of local cattle, selection of the most promising breeds and crossbreeding of these indigenous breed with high producing exotic cattle has been considered as a practical solution [7].

The productivity of dairy cattle breeds depends mainly on their reproductive performance and efficiency of service per conception. Reproductive performance is a characteristic of outstanding importance in dairy cattle business. Among reproductive performance traits: age at first service, number of service per conception, calving interval, age at first calving, days open, first service per conception, gestation length, calving rate, non returning and returning rate of service are the bases of profitable production for dairy farm [8]. The objective of this study

is to generate information about the reproductive performance of indigenous cattle based on Meta analysis.

MATERIALS AND METHODS

Search for articles

The literature review of the research focused on reproductive performance of indigenous cattle (Fogera, Boran, Metema, Arisi, Barca, Begait, Ogaden and Horro) that found in Ethiopia. The search for publications was made in national and international scientific and technical journals (full length article, review article, text book and Books), as well as publications from national or international conferences. And also used the ISI database Web of Knowledge to obtain papers referenced in the database, although it was completed with an electronic search of other studies not referenced therein. For this meta-analysis 57 different published papers were reviewed.

Criteria for inclusion in the meta-analysis

Several criteria were used to analysis different reproductive traits for meta-analysis included like age at puberty, age at first calving, calving interval, days open and number of services per conception.

Preparing the list of studies

After gathering all of the information, it was tabulated in Excel. Data included in the analysis were published over a 27 years period (between 1989 and 2016). Several publications included more than one animal (different breeds and traits). The factors for grouping animals were breed (Fogera, Boran, Metema, Arisi, Barca, Begait, Ogaden and Horro) and traits (age at puberty, age at first calving, calving interval, day open and number of services per conception)

Data collection

Data was collected from different sources by help of different Google and web site done on the reproductive performance and dairy production of different indigenous cattle breeds. The data were collected from 8 indigenous breed and for 5 reproductive traits.

Data analysis

After collecting the necessary data from full length article, review articles, text book and books for analyses, preliminary editing was performed to adjusted orderly the data entered and coded using Microsoft Excel. Coding of data into segments prepared and facilitated statistical software analysis which was conducted using the Statistical Analysis System [9] and Statistical Package for Social Science [10]. Least square means and correlation of reproductive performances among different breed parameters like age at first service (AFS), age at first calving (AFC), calving interval (CI), days open (DO) and number of services per conception (NSC) are analysis. Pearson's correlation coefficients were estimated between reproductive traits [9].

Result and Discussion

Reproductive performances of indigenous cattle in Ethiopia

Reproductive traits describe the animal's ability to conceive, calve down and suckle the calf to weaning successfully [11]; these traits are important since they affect the herd size. Reproductive performance is commonly evaluated by analyzing female reproductive traits [12] of a combination of many traits [13]. The main indicators that would be considered in assessing reproductive performance are age at puberty, age at first calving, calving interval, days open and number of services per conception [12, 14].

The least square means of reproductive performance were present in Table 1. In this study the maximum mean of AFS was 52.80 ± 6.25 months for Metema Highland Zebu (Metema H/Zebu) breeds and the minimum mean of AFS was 24.73 ± 6.66 months for Arsi breeds. Based on the present study the overall least squares means of AFS, AFC, CI, NSC and DO for Arsi breeds were 24.73 ± 6.66 , 33.53 ± 6.43 , 14.67 ± 1.16 , 1.93 ± 0.208 and 6.30 ± 0.755 respectively. The overall least squares means of Barca breed of AFS, AFC, CI, NSC and DO were 24.90 ± 3.22 , 30.00 ± 4.58 , 13.20 ± 3.46 , 1.10 ± 0.059 and 8.42 ± 0.108 respectively.

Age at First Service (AFS)

It is the age at which heifers attain body weight, body condition and sexual maturity for accepting service for the first time. It influences both the productive and reproductive life of the female through its effect on her lifetime calf crop. Age at first service is influenced by genotype, nutrition and other environmental factors. Age at first service in this study was 44.567 ± 0.9713 months for Fogera. This is similar to age at first service reported to be 44.8 months for Fogera breeds [15]. In addition, age at first service reported to be 55 months for Horro breed [16]. It is relatively higher than in this study age at first service 50.933 ± 3.5218 months for Horro breeds. Age at first service Boran breed was 44.567 ± 0.9713 months. This is lower than 53.9 months reported for Boran breed by [17]. Age at first service in this study was 37.200 ± 4.0632 months for Ogaden breeds. This is relatively higher than 34.4 months

for Ogaden breed reported by [18]. Moreover, irregularities in feed supply and differences in management systems may bring about variations in age at first service in different areas [19].

Age at First Calving (AFC)

The least squares mean of Ogaden breeds age at first calving (AFC) obtained in the present study was $50.565 \pm .5151$ months. The reported value (50.83 ± 0.36 months) is comparable with the value obtained for Ogaden breed reported by [20]. However, it is relatively smaller than the values for Boran breed of AFC 52.667 ± 8.5448 months in this study and Fogera breed of AFC reported (50.8 ± 0.36 months) smaller than from this study of Fogera breeds of AFC 54.033 ± 4.2899 months.

Calving Interval (CI)

The least squares mean of calving interval in this study was 18.700 ± 3.5511 months for Boran breeds. When compared to $17.8 \pm .59$ months for Boran breed reported by [17] relatively higher and 24.967 months reported for Fogera breed reported by [15] smaller than from this study 21.467 ± 3.4962 months. The least square mean of calving interval in this study was 17.500 ± 2.2113 months for Metema Highland Zebu. This is relatively lower than 19.2 months for Metema Highland Zebu reported for Calving interval varies slightly due to breed, calf sex, calf size, dam age, year, and month of calving [21].

Number of Service per Conception (NSC)

The least squares mean of NSC in the present study was $1.933 \pm .2082$ for Arsi breeds. It is relatively smaller when compared to for Arsi breeds reported by [22]. The least square mean of NSC was $1.100 \pm .0586$ for Barca breed in the present study. The value of the present study is lower than the value of 1.11 reported for Barca breed by [23]. The least squares mean of Fogera breeds NSC $1.480 \pm .1778$ similar to 1.54 for Fogera breed reported by [19], the least squares mean of Boran breed of NSC in this study was $1.883 \pm .2783$ months and also similar to 1.81 for Boran breed reported by [23].

Day open (DO)

Days open affects lifetime production and generation interval [17]. Days open should not exceed 80 to 85 days, if a calving interval of 12 months is to be achieved [24]. Increases in the number of days open between calving and conception, also known as days open, influences profitability of the dairy industry. This influence is partly attributed to factors such as increased breeding cost, increased risk of culling and replacement costs, and reduced milk production [25]. The least square mean of day open in the present study was 8.133 ± 2.7209 months for Fogera breeds. The least square mean of DO in this study was 8.700 ± 3.5156 months for Boran breeds. According to [26] reported 11.3 months for Boran breed is higher than from the present study.

Table 1. Least square means of indigenous cattle reproductive performance

Breeds	Means +STD				
	AFS (month)	AFC (month)	CI (month)	NSC (No)	DO (month)
Arsi	$24.73 \pm .666$	$33.53 \pm .643$	$14.67 \pm .116$	$1.93 \pm .208$	$6.30 \pm .755$
Barca	$24.90 \pm .322$	$30.00 \pm .458$	$13.20 \pm .346$	$1.10 \pm .059$	$8.42 \pm .108$
Begait	$35.30 \pm .721$	45.12 ± 6.203	$17.06 \pm .040$	$1.80 \pm .200$	$8.20 \pm .361$
Boran	44.17 ± 10.893	52.67 ± 8.545	18.70 ± 3.551	$1.88 \pm .482$	8.70 ± 3.516
Fogera	$44.57 \pm .971$	54.03 ± 4.289	21.47 ± 3.496	$1.48 \pm .178$	8.13 ± 2.721
Horro	50.93 ± 3.522	54.23 ± 4.966	14.80 ± 2.706	$1.93 \pm .214$	$4.80 \pm .300$
Metema/H/Zebu	$52.80 \pm .625$	50.17 ± 4.378	17.50 ± 2.211	$1.71 \pm .103$	$6.63 \pm .379$
Ogaden	37.20 ± 4.063	$50.57 \pm .515$	$16.40 \pm .866$	$2.10 \pm .473$	$6.15 \pm .379$

AFS = Age at First Service, AFC = Age at First Calving, CI = Calving Interval, NSC = Number of Service per Conception and DO = Day Open

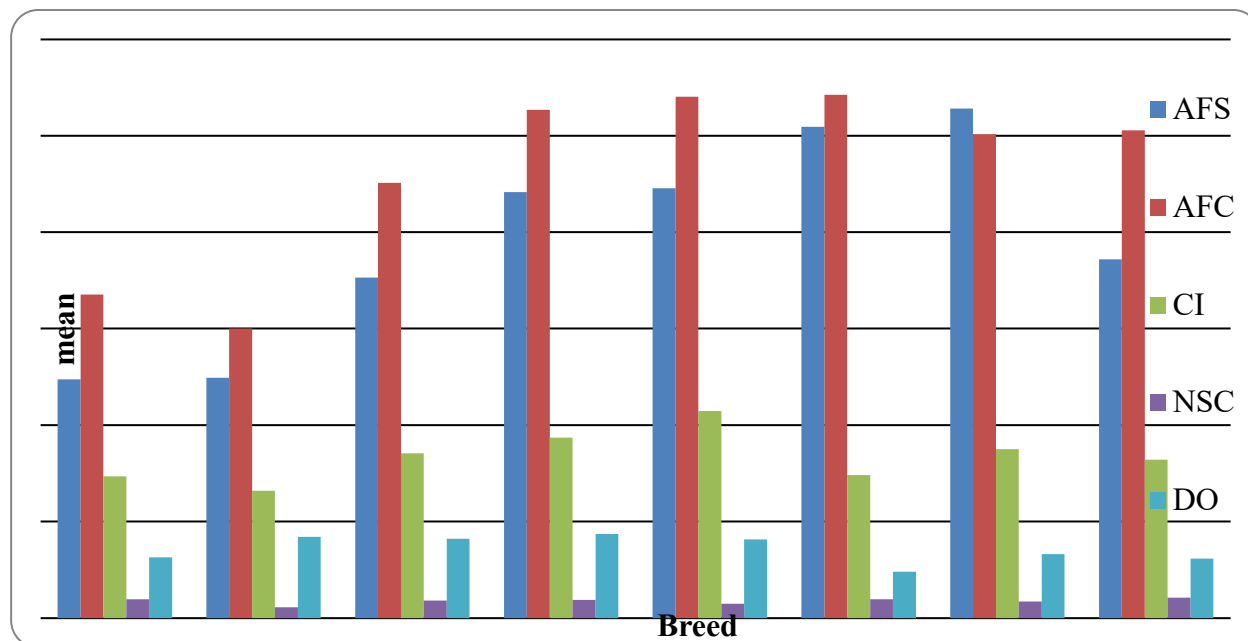


Figure 1. Reproductive performance of indigenous cattle
 AFS = Age at First Service, AFC = Age at First Calving, CI = Calving Interval, NSC = Number of Service per Conception and DO = Day Open

Correlations among female reproductive traits

Most of the pair-wise genetic correlations between the reproductive traits were moderately related. Genetic correlation between age at first service and the age at first calving (0.72) were highly correlated. Age at first service was moderately correlated with the calving interval. Genetic correlation among age at first calving was moderate and positively correlated with number of service per conception and calving interval. Age at first service was negatively correlated with day opens.

Table 2: Genetic correlations between reproductive traits

Traits	AFS (months)	AFC(month)	DO(month)	NSC(month)	CI(month)
AFS(months)	1	.72**	-.159	.367	.505*
AFC (months)		1	.047	.507*	.484*
DO (months)			1	-.369	.259
NSC (No)				1	.274
CI (months)					1

AFS = Age at First Service, AFC = Age at First Calving, CI = Calving Interval, NSC = Number of Service per Conception and DO = Day Open

Conclusion and Recommendation

The reproductive performances of indigenous cattle are very poor. Genetics and non-genetics factors are major factors for reproductive traits of indigenous breed in Ethiopia like genotype, housing, nutrition, disease prevalence generally management. The result shows that age at first service of Arsi and Barca is shorter than other indigenous breed whereas age at first service of Metema Highland Zebu breed is longer than the other. The value of number of service per conception of Barca is smaller than others whereas the value of number of service per conception of Ogaden is higher than other indigenous breeds. The reproductive performances of Ethiopian indigenous cattle shows lower productive. Therefore, to improve these poor reproductive performances of indigenous breeds to establish genetic improvement policy, strategy and breeding program and to implement well management practices.

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