International Journal of Animal Science, Husbandry and Livestock Production ISSN: 2141-5191, Vol. 7(3), pp. 389-397, March, 2021. Available online at www.advancedscholarsjournals.org © Advanced Scholars Journals

Full length Research paper

Analysis of fertility, embryonic death, hatchability of artificial incubator used and egg quality of indigenous chickens' ecotypes in Gambella regional state Ethiopia

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Accepted 11th March, 2021

The study was conducted to evaluate the egg fertility, embryonic death, hatchability, and egg quality traits of indigenous chickens artificially hatched under intensive management conditions in Gambella region Ethiopia. Eggs laid during one week up to 10 days were collected from households of the districts and transported to Gambella University for fertility, Embryonic death, hatchability and egg quality analysis.For fertility, embryonic death and hatchability atotal of 880 eggs (220 eggs from each districts) were incubated using the incubator at Gambella University for hatching purpose. Egg quality was investigated in terms of egg weight, egg length, egg width, albumen weight, yolk weight, shell thickness (from the narrow, middle and wide parts), shell weight, yolk color, Albumen height, yolk height, yolk width and Haugh Units Score (HU). The value of the egg fertility of the current study was 89.09 %, 85.45 %, 81.36 % and 78.18 % of Abobo, Gambella ketema Zuria, Itang and Lare ecotypes respectively. The hatchability values of the on eggs set basis were 82.27 %, 76.82 %, 68.64 % and 67.27 %, of the Abobo, Gambella Ketema Zuria, Itang and Lare ecotypes, respectively. The mean value of egg weight and the shell thickness in the current findings was 39.15 g and 0.28 mm, respectively. The mean value of the albumen height and albumen weight of the current study was 4.17 mm and 20.53 g, respectively. There was no significant difference between ecotypes in terms of hatchability on fertile eggs and some amount different on the total egg set basis.

Key words: Chicken, egg quality, fertility, hatchability, traits.

INTRODUCTION

Chicken products are the primary affordable sources of animal source food in rural household since they cannot inquire the cost of small and large ruminants' price. Chicken production is thus vital to meet food security by producing a high-quality animal source protein and being income source to most rural populations (Melesse, 2014). Adaptation of harsh environment and resistance to disease are the major opportunities of local chicken in Ethiopia and contributed to the national economy in general and the rural economy in particular. The 68.46 % of annual meat productions are produced by poultry and the egg productions are contributed by Indigenous chicken, hybrid and exotic breed with an average annual output of 85,918,543, 16,137,806 and 34,707,761 of egg production, respectively (CSA, 2017/18).

Despite their low productivity, indigenous chickens are known to possess desirable characteristics such as thermo-tolerance, resistance to some diseases, good

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egg and meat flavor, presence of hard egg shells, high fertility and hatchability as well as high dressing percentage (Aberra*et al.,* 2011). Production of both egg and chicken's meat has certainly assisted in reducing the gap in the supplies of animal source protein for human consumption (Leta and Bekana,2010). Fertility refers to the percentage of incubated eggs that are fertile while hatchability is the percentage of fertile eggs that hatched.

Fertility and hatchability are a major parameter of reproductive performances which are most sensitive to environmental and genetic influences (Sapp *et al.,* 204). An egg is said to be infertile when it fails to show any evidence of developing embryo (Miazi et al 2012).The general quality traits of an egg can be discussed under two broad categories/parameters namely, external and internal quality parameters (Monira*et al.,* 2003). The internal quality traits of the egg are measured on the basis of the quality of the albumens as indicated by Haugh Units (HU), the relative size of the various internal components and the integrity of the egg shell membranes. Several studies have been done these egg quality assessments in chickens (Tona et al., 2002, De ketelaere et al., 2004) as well as changes in the micro environment provided by the egg during storage and early incubation and how these affect hatchability (Narushin and Romanov,2002;Tona et al., 2002; Reijrink et al., 2008).

In Gambella regional state of Ethiopia studies to show the egg fertility, hatchability, embryonic death and egg quality of indigenous chickens have never been conducted. Therefore, the purpose of the study was to evaluate the egg fertility, embryonic death, hatchability, and egg quality traits of indigenous chickens artificially hatched under intensive management conditions in Gambella region Ethiopia.

MATERIALS AND METHODS

Description of the study area: The study was conducted at four selected districts of Gambella region, west Ethiopia from March 2019- July 2020.

Site selection

The Gambella region consists of 3 zones which are contains 13 districts. Four districts were purposively selected based on indigenous chicken populations, accessibility of the districts, Security safety and representativeness for the study areas. Based on this the Abobo, Gambella ketemaZuria, Itang and Lare districts area were used.

METHODS OF DATA COLLECTION

Fertility, embryonic death and hatchability.

Eggs laid during one week up to 10 days were collected from households from the districts and transported to Gambella University for fertility, Embryonic death, hatchability and egg quality analysis. The collected eggs were labeled with the code given to the districts at the time of collection from the respective households of each districts. Eggs were collected only from indigenous chicken populations produced were identified at time of collection. A total of 1600 eggs (400 eggs from each districts) were collected and transported to the university after arrival to the university, the eggs were again sorted for their appropriate size, cleanness and some debris contains for all districts were washed out by using water and alcohol mixed to safe the air pores/inertances of the eggs shell. Upon arrival, the eggs were fumigated with formaldehyde gas (17g $KMnO_4$ +100ml of 20% formalin) and incubated using the Institute's incubator to hatch the day-old chicks. Then, finally atotal of 880 eggs (220 eggs from each districts) were incubated using the incubator at Gambella University for hatching purpose. The incubation temperature, humidity and turning device were adjusted according to the recommendations of the manufacturer.

Candling process:

Candling of incubated eggs was done on the 7th, 14th and 18th day of the incubation. Candling was carried out on the 18th day of incubation for the identification of fertile eggs, and clear eggs. The process was carried out in a dark room using a Candler fixed with a neon fluorescent tube. The eggs were placed on the Candler for easy penetration of light through the eggs and the eggs were viewed against the source of light. The fertile eggs were seen to be densely clouded and opaque with network of veins indicating development of embryo within the eggs while the unfertile eggs were translucent under the light.

Number of infertile and embryonic mortality was recorded. After candling, the fertile eggs were transferred into the hatching tray according to the ecotypes into the hatchery unit and spent three days. After the chicks hatched, they were leaved in the hatchery until 90% were dried. On the 21st day, the numbers of hatched chicks including the normal, weak, abnormal chicks and dead chicks after hatch were recorded.

Finally, fertility was calculated for the 220 eggs collected from each district's as:

$$\text{Fertility}(\%) = \frac{\text{Total number of fertile eggs}}{\text{Total number of eggs set}} \times 100$$

Mortality

Mortality (on hatching day) percentage of indigenous chicken egg was recorded throughout the study period. Mortality was calculated on fertile egg basis using following formula:

$$\text{Mortality}(\%) = \frac{\text{Total number of dead chicks}}{\text{Total number of fertile eggs}} \times 100$$

Embryonic death results were calculated for 220 eggs collected from each district's incubated and developed the chicks checked while candling as:

$$\text{Embryonic death }(\%) = \frac{\text{Total number of died chickes in eggs before hatched}}{\text{Total number of chickes hatched}} \times 100$$

The hatchability values were calculated for 220 eggs collected and incubated from each district's as:

$$\text{Hatchability}(\%) = \frac{\text{No. of chicks hatched}}{\text{No. of fertile eggs after candling}} \times 100$$

Eggs quality parameters:

Egg quality was investigated in terms of egg weight, egg length, egg width, albumen weight, yolk weight, shell thickness (from the narrow, middle and wide parts), shell weight, yolk color, Albumen height, yolk height, yolk width and Haugh Units Score (HU). All weight data was taken by sensitive balance. The shell thickness was the average of the thickness of blunt, middle and sharp points of the egg and was measured using a micrometer gauge. Yolk color fan consisting of a series of fifteen colored plastic strips was used as a reference to determine yolk color, with 1 rated as very pale yellow and 15 as deep intense reddish orange. Yolk height and albumen height were measured by tripod micrometer. The albumen of the broken eggs was carefully separated from the yolk. Albumen and yolk weights were measured by using sensitive balance. The average Haugh Unit value for each district were calculated by using the formula given by Stadelman and Cotterill (1986).

Haugh Unit (HU) = 100 Log [H- G (30W0.37-100) +1.9]
100

Where, HU= Haugh unit, G= Gravitational constant, 32.2, H= Albumen height(mm) and W= weight of egg.

Statistical analysis

All data were coded and recorded in Microsoft excel sheet. All data collected from both internal and external egg quality parameters, fertility, embryonic death and hatchability were analyzed. Descriptive statistics such as mean, frequency and percentage were calculated, and all the recorded data were analyzed. The descriptive statistics (mean±SE) for numerical survey data was subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of SAS version 9.4, 2017. Mean comparisons were made by using Tukey`sstudentized range test method at $p<0.05$. The statistical model used was:

$Y_{ij} = \mu + E_i + e_{ij}$, Where,

Y_{ijk} = an observation for a given variables.

μ = overall mean.

E_i = effect of the i^{th} ecotypes (i: 1, 2, 3,4).

e_{ijk} = residual random error.

RESULTS AND DISCUSSION

Fertility, embryonic death and hatchability of eggs used by artificial incubator

The general values and percentage of egg set, fertility, embryonic death and hatchability estimated in all chicken ecotypes studied were presented in Table 1. The eggs set from Abobo, Gambella ketemaZuria, Itang and Lare ecotypes were totally 880 (220 from each ecotypes), respectively. The value of the egg fertility of the current study was 89.09 %, 85.45 %), 81.36 %) and 78.18 %) of Abobo, Gambella ketemaZuria, Itang and Lare ecotypes respectively. From the number of eggs set in all the ecotypes, Abobo ecotype had the highest percentage (89.09 %) fertility followed by Gambella KetemaZuria with 85.45%. The values and percentage of fertility in this study was in line with the value reported 76.14% for normal feather bird's ecotype and 77.67% for Naked neck ecotypes fertility of Nigerian locally adapted chickens, respectively (Adedeji, *et al.,* 2015). According to the results obtained, the current study showed higher value of fertility than the value reported 74.5 % of fertile eggs from eggs set by AhmedinAbdurehman and Mangistu Urge (2016).The current findings on fertility values was higher than the value reported by NureHasni Desha and A.K.F.H. Bhuiyan (2018), in artificial incubation system the average fertility of indigenous chicken eggs were 70.81 % and the fertility results obtained in the present study were lower than Rahman*et al.* (2013) who found 96.33% fertility and the present findings were similar with the value reported by Faruque*et al. (*2013) where the fertility for incubator hatched chickens were 92.59, 89.87, 94.39%, respectively for H, NN and ND genotypes. The present results also were in line with Khatun*et al.* (2005) who found 88.09 to 94.86% fertility for ND, H and NN genotypes. The results were higher than Msoffe*et al.* (2004) who found 70% fertility for artificially incubated indigenous chicken.

The fertility of the study was similar with the value reported by Ahmad *et al.* (2013) where the fertility was 77% and by-far higher than the value reported by Faruque*et al.* (2011) found 46.69% fertility in Hilly chickens and also the fertility value of the present study was similar to Islam and Nishibori (2009) where 71.5-92.7% fertility was found for naturally hatched indigenous chicken. The current results were also similar with the value reported by Bhuiyan*et al.* (2005) where fertility of natural hatching was 83.0 %. The lower fertility of indigenous chicken in the current study might be due to the cock shortage in the area, egg storage time before incubation, transportation of collected eggs from households to hatchery room and the overall monitoring systems during incubation period. The current value of the embryonic death in eggs shell were 7.65 %, 10.11 %, 15.64 % and 13.95 % of the Abobo, Gambella ketemaZuria, Itang and Lare ecotypes, respectively.

The present study findings were lower than the value reported by (Adedeji*et al.,* 2015), the average mortality on hatching day of indigenous chicken egg was 19.63 % and also the current results were lower than the value reported by (Adedeji*et al.,* 2015) on the dead-in-shell was highest in naked-neck eggs of (25%) while higher than the value which was observed in normal feather eggs (3.33%). The embryonic death before hatched in the eggs shell might be due to the lack of monitoring the overall manipulation of the incubator such as temperature, moisture and electric power. However, such expanded information about embryonic death in the eggs shell before hatched of chicks were not available in other scenarios. The hatchability values of the on eggs set basis were given in (Table 1 and Figure 1) which were 82.27 %, 76.82 %, 68.64 % and 67.27 %, of the Abobo, Gambella KetemaZuria, Itang and Lare ecotypes, respectively. The current finding was similar with the value reported by NureHasni Desha and Bhuiyan (2018) on the artificially incubated indigenous chickens' hatchability which was 77.52 and the value reported by Sonaya and Swan (2004) that hatchability from 65-75% should be expected in case of mini hatchery which is almost similar with the present study. The hatchability values of the on fertile eggs basis were 92.35 %, 89.89 %, 84.36 % and 86.05 %, of the Abobo, Gambella KetemaZuria, Itang and Lare ecotypes, respectively. The hatchability results obtained in the present study were similar with the value reported by Rahman*et al.* (2013) who found 91.35% hatchability and Faruque*et al. (*2013) where the hatchability for incubator hatched chickens were 79.81, 64.85, 86.38%, respectively for H, NN and ND genotypes.

The present results also were in line with the value reported by Khatun*et al.* (2005) who found 78.33 to 90.79% hatchability for ND, H and NN genotypes. The hatchability was higher than Rota *et al.* (2010) where the average of hatchability rate was 67% and Patrick *etal.,*(2014) where hatchability rates were 51.58, 50.26 and 40.56% for Normal, Naked Neck and Dwarf strain. The hatchability was higher than Ahmad *et al.* (2013) where the hatchability on fertile egg basis was 34.70%. The hatchability values in current study were in line with the reported value by Kalita*et al.* (2009) in Assam (70 - 81 %) and Portas*et al.* (2010) in Kenya (45-100 %, with mean hatchability of 81.5 %), Kirunda and Muwereza, (2011) in Uganda. The current study findings were also similar with the value reported by AhmedinAbdurehman and Mangistu Urge (2016) on the indigenous chickens had significantly higher percentage of hatchability on fertile eggs (91.46 %) and hatchability on total egg set (67.78 %) and the present study was concurred with the report of Kingori (2011) who reported that the most influential egg parameters that influence hatchability such as egg weight, shell thickness and appropriately monitoring while incubation period the set eggs. There was no significant difference between ecotypes in terms of hatchability on fertile eggs and some amount different on the total egg set basis.

This might be due to lack of eggs selected/identified while candling and not seriously follow up till hitching day of date. From the current study values, the infertility percentages were 10.91 %, 14.55 %, 18.64 % and 21.82 % of the Abobo, Gambella ketemaZuria, Itang and Lare ecotypes respectively and these findings were higher than the value reported by (Adedeji, *et al.,* 2015) that infertility was observed to be highest in Frizzle feather hens with 32.28% ecotype.

Table 1.thevalues and percentage of egg set, fertility, infertility, embryonic death and hatchability estimated in all chicken ecotypes in Gambella region, Ethiopia

Parameters	**N**	**Chickens ecotypes**				**Overall mean**
		AB	**GKZ**	**IT**	**LA**	
Egg set	880	220	220	220	220	-
Fertile eggs	735	196(89.09%)	188 (85.45 %)	179 (81.36 %)	172 (78.18 %)	184
Infertile eggs	145	24 (10. 91 %)	32 (14.55 %)	41 (18.64 %)	48 (21.82 %)	36
Embryo dead in shell	86	15 (7.65 %)	19 (10.11 %)	28 (15.64 %)	24 (13.95 %)	22
Hatchable eggs set basis	649	181(82.27 %)	169 (76.82 %)	151 (68.64 %)	148 (67.27 %)	163
Hatchable fertile eggs basis	735	196(89.09%)	188 (85.45 %)	179 (81.36 %)	172 (78.18 %)	184

AB = Abobo ecotype, GKZ = Gambella ketemaZuria ecotype, IT = Itang ecotype, LA = Lare ecotype.

Figure 1.part of collected eggs from households incubated and hatched used artificial incubator

Egg quality traits

The external egg quality traits such as, egg weight, egg length, egg width, shell weight, and shell thickness were presented in Table 2. The result of the present findings on the egg reared in Abobo, Gambella ketemaZuria,Itang and Lare districts was in line with the finding of local chicken reared in Hawassa and Yirgalem reported by (Yonas*et al.*,2019) and similar with the finding of several researchers from Ethiopia (Mesere, 2010; Aberra et al., 2012). The mean value of egg weight in the current findings (39.15 g) was in agreement with the value of mean egg weight in Bench Maji zone of Southern Nations, Nationalities and People Regional State, Ethiopia (43.9 g) reported by (Welelaw*et.al.*,2018), Melesse*et al.* (2010) and Meseret (2010). Getachew*et al.* (2016) also reported comparable egg weight value of 41.1 g for indigenous chicken western Shewa zone of Oromia region, Ethiopia.

On the contrary, Halima (2007) reported lower egg weight values (34.1 g to 41.7 g) for different chicken ecotypes in northwestern part of the country. This could be due to the type of chicken ecotype, feed availability, environmental temperature and the agro-ecological location of the study sites. The current study reported that the mean value of the egg length and egg width of the studied ecotypes were (48.98 mm) and (37.55 mm) respectively. The results were similar with the finding reported by (WelelawEdmew*et,.al*,2018) the egg length and egg width in Bench Maji zone of Southern Nations, Nationalities and People Regional State, Ethiopia were 52.1 mm 37.8 mm.

The mean value of the shell thickness (0.28 mm) in the current study was similar with the value reported by (Welelaw *et al.,*2018) the shell thickness (0.33mm) in in Bench Maji zone of Southern Nations, Nationalities and People Regional State, Ethiopia and comparable with that of Desalew*et al*. (2015), who reported 0.31 average shell thicknesses in East Shewa, Ethiopia. On the other hand, Fisseha*et al.* (2010) reported lower value of shell thickness (0.26 mm) in northwestern Ethiopia. Whereas,Melesse*et al.* (2010) observed a relatively higher shell thickness value (0.37 mm) in Ethiopian Naked neck chickens reared under improved production system. These variations in shell thickness among the indigenous chicken ecotypes reared in various parts of the country might be due to the availability of mineral calcium in the feed material, type of management (intensive vs. scavenging), and type of chicken breed. According to King'ori (2012), shell thickness is influenced by calcium availability in layer nutrition and ability of the hen to absorb calcium by the shell gland. Higher value of shell thickness reported in the current finding might be due to better calcium content of the available scavenging feed resources in the study area.

The mean value of the egg shell weight (3.11 g) of the studied indigenous chickens' ecotypes are lower than the value(3.82g) reported by (YonasKejela, *et al.,*2019) in Yirgalem and Hawassa towns, Ethiopia and the values reported by Meseret (2010) who recorded that the weight of the shell of fresh and aged egg of the indigenous chickens was 4.61 and 4.35 g, respectively. The shell weight is also lower than what was reported by Markos*et al.* (2017) for chickens reared in the highland, midland and lowland 5.05, 4.72 and 4.30 g, respectively. Ahmedin and Mangistu (2016) from Eastern Hararghe, Ethiopia also revealed that higher value for shell weight. The observed variation on the shell weight could be due to availability of calcium in the diet and also the bioavailability of calcium and phosphorus (Pelicia et al.,2009).

The internal egg quality traits such as albumen height (mm), albumen weight (g), yolk height (mm), yolk width (mm), yolk weight(g), yolk color (1-15) and Haugh unit were presented in (Table 2). The mean value of the albumen height of the current study was (4.17 mm) which was similar with the value reported by Meseret (2010) and Aberra et al. (2012 for fresh eggs at 2.87 and 4.51 mm, respectively from indigenous chicken reared at Jimma and Amhara. The mean value of the albumen height(4.17 mm) of the current study was lower than that of the value of finding of Yonas*et al*., (2019) who reported that the height of albumen among eggs of local chickens collected from Yirgalem and Hawassa towns, was 5.7 and 5.20 respectively and the value of findings of Markos*et al.* (2017) who reported that the height of albumen among eggs of indigenous chicken collected from highland, midland and lowland agro-ecologies of Western zone Tigray, was 5.66, 5.65 and 5.05, respectively. The current findings are also lower than that of the findings of Alewi*et al.* (2012) and Mube*et al.* (2014) for local Kei chicken (5.79 mm) raised in Guraghe zone and also native chickens (5.74 mm) from Cameroon, respectively.

The mean value of the albumen weight (20.53 g) of the current study was lower than that of the value (23.1g) reported by Welelaw*et.al* (2019) in Bench Maji zone of Southern Nations, Nationalities and People Regional State, Ethiopia. The low albumin height and the resulting HU in the current study might be due to the age of hen duration of the egg storage after being collected and environmental temperature. The current study revealed that the mean value of the yolk height and yolk width were 13.59 mm and 37.98 mm respectively.

The findings were concurrent with the value reported by, Meseret (2010) 11 mm yolk height for fresh eggs and 9.1mm for market purchased eggs. However, Melesse*et al*. (2010) reported higher (16.9 mm) yolk height in eggs of naked neck indigenous chicken. These differences might be due to the duration and storage temperature as well as the age of the hens. The genetic potentials of individual chicken ecotypes may also contribute to show that differentness. The mean value of the current study of the yolk color (5.23) was similar with the findings of Halima, (2007) who reported a yolk color ranging from 3.0 to 4.0 for different indigenous birds in northwestern Ethiopia. However, lower than that of the value reported with the findings of Welelaw*et.al* (2019), Melesse*et al*. (2010), Meseret (2010) and Getachew*et al.* (2016). The variation value of yolk color (Figure 2)in the current study and in another place in the country might be due to the quality and availability of greenish scavenge able feeds in the free-range production system**.** The mean value of the current study on haugh unit (HU) of the indigenous chickens reared in the studied areas were 68.48 which was higher than the values of the HU of the eggs from the native chickens on these results was higher than those reported by Meseret (2010) for fresh and aged eggs (54.50 and 46.74), respectively.

Table 2 The external and internal egg quality traits of indigenous chicken population in Gambella Region

Parameters	Ecotypes and their external egg quality traits A (N=100) (Mean±SD)	GKZ (N=100) (Mean±SD)	IT(N=100) (Mean±SD)	La (N=100) (Mean±SD)	Over all mean
Egg weight (g)	38.97 ±0.23[b]	41.55 ±0.29[a]	38.02 ±0.21[b]	38.04 ±0.22[b]	39.15 ± 0.24
Egg length (mm)	48.49 ±0.04[b]	50.15 ±0.09[a]	48.37 ±0.06[b]	48.91 ±0.08[b]	48.98 ± 0.07
Egg width (mm)	37.11 ±0.22[b]	39.10 ±0.29a	36.96 ±0.24[b]	37.02 ±0.26[b]	37.55 ± 0.25
Shell weight (g)	3.06 ±0.03[b]	3.31 ±0.08[a]	3.02 ±0.06[b]	3.05 ±0.04[b]	3.11 ± 0.06
Shell thickness (mm)	0.28 ±0.23[b]	0.32 ±0.27[a]	0.24 ±0.23[d]	0.26 ±0.25[c]	0.28 ±0.26
Albumen height (mm)	4.15 ± 0.01	4.29 ± 0.03	4.11 ± 0.01	4.13 ± 0.02	4.17 ± 0.01
Albumen weight (g)	20.27 ± 0.13[b]	21.68 ± 0.17[a]	19.97 ± 0.15[b]	20.21 ± 0.16[b]	20.53 ± 0.15
Yolk height (mm)	13.55 ± 0.07[b]	14.16 ± 0.11[a]	13.21 ± 0.09[b]	13.43 ± 0.08[b]	13.59 ± 0.09
Yolk width (mm)	37.73 ± 0.12[b]	39.08 ± 0.15[a]	37.42 ± 0.14[b]	37.69 ± 0.11[b]	37.98 ± 0.13
Yolk weight(g)	13.90 ± 0.07[ab]	14.26 ± 0.09[a]	13.41 ± 0.06[bc]	13.71 ± 0.08[c]	13.82 ± 0.08
Yolk color (1-15)	5.21 ± 0.01[ab]	5.39 ± 0.05[a]	5.13 ± 0.02[b]	5.17 ± 0.04[b]	5.23 ± 0.03
Haugh unit	68.28 ± 5.31	69.83 ± 6.23	67.46 ±6.12	68.35 ±5.72	68.48 ± 5.85

A: Abobo, GKZ: Gambella KetemaZuria, IT: Itang, La: Lare, [a,b,c]Means with different superscripts across column (ecotypes) are significantly different ($P< 0.05$).

Figure 2.the value of yolk color identification.

CONCLUSION AND RECOMMENDATIONS

From the number of eggs set in all the ecotypes, Abobo ecotype had the highest percentage fertility followed by Gambella KetemaZuria. The lower fertility of indigenous chicken in the current study might be due to the cock shortage in the area, egg storage time before incubation, transportation of collected eggs from households to hatchery room and the overall monitoring systems during incubation period. The mean value of the albumen weight of the current study was lower than that of the value reported by Welelaw in Bench Maji zone of Southern Nations, Nationalities and People Regional State, Ethiopia. These differences might be due to the duration and storage temperature as well as the age of the hens. The genetic potentials of individual chicken ecotypes may also contribute to show that differentness. Therefore, it is better to manage the eggs collected early to increase the fertility and hatchability of the eggs and additional to reduces the variation of egg quality the overall improved scientific management should be applied.

ACKNOWLEDGEMENTS

The authors express their appreciation to the Gambella University for study leave. ILRI (International Livestock Research Institute, ACGG program) solely acknowledged for sponsoring the first author for Graduate fellow and cover all required research fund.

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