

CURRENT SITUATION AND CHALLENGES FOR LIFTING UP RABBIT PRODUCTION IN EGYPT INTO INDUSTRIAL LEVEL

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ABSTRACT

In Egypt, during the last ten years, rabbits play crucial role in animal production sector. But, they facing many obstacles including heat stress, diet quality, management skills and recent techniqualties. In Egypt, rabbits are reared purposely to achieve family needs of protein and save some family cash income. Unfortunately, this led to a reduction in rabbit's economic value, because more than 80% of rabbit production are in the hand of small-scale producers and some of them may not well qualified to breed rabbits. The current situation (increasing population census with increasing animal protein demand), is calling for expanding rabbit production efficiency

and shifting it to large or industrial scale. This lofty step will require those small breeders to shift and expand their objectives of rabbit farming.

So, this review will evaluate the current situation of rabbit production in Egypt, with references to the obstacles facing rabbit production. The role of researchers in guiding and training smallholders on rabbit farming and what are those breeders need to be well qualified in rabbit production. Trying to maximize rabbit production and lifting it up into industrial level.

Keywords: Rabbit stock, meat production, smallholders, industrial level, Egypt, obstacles, heat stress, Egypt

INTRODUCTION

Egypt's sustainable development strategy (2030) is aiming to reduce level of poverty, improving and developing livelihood. Actually, the poverty rate in Egypt was less in 2019/2020 (29.7%), than that in 2017/2018 (32.5%) according to the report of **EMPED (2021)**. It is expected that, the population census in Egypt will reach to 151 million by 2050 based on **FAO (2017)** report, leading to increasing animal protein demand. This will require livestock farmers to expand their production, consequently improve their livelihoods. Commercial farms and large holders occupy less than 10 % of poultry production sector and about 21%

of large animal production (FAO, 2017). Unfortunately, the majority of farm animals are kept by small holders, and about 54% of them are poor. Who do not have sufficient information to improve or expand their production on a technology basis (FAO, 2020). So, in the upcoming period we need to draw more attention to animals that can share in solving the increasing demand for animal protein, which are rabbits.

In developing countries, rabbit farms can be sustained due to their unique features. Such as, having a faster growth rate, higher feed conversion ratio, ability to produce near to 40 kits per year vs. one calf/year in large animals. In addition, they can feed on garden forages and produce high quality protein (Mustsami and Karl, 2020). Moreover, rabbits do not cause harmful effects to the environment as the large animals do. Hydayat *et al.* (2021) confirmed this point; they collected manure from buffalo, cattle, goats, chicken, duck and rabbits and calculated the produced methane (in chambers specific for measuring methane) from their manure for 8 weeks. They found that, ducks were the largest methane producer (total methane during 8 weeks was 97.99 mg/g). Both buffalo and cattle recorded 20.93 mg/g and 20.32 mg/g, respectively. While, chicken produced 17.88 mg/g, 6.01 and 2.70 mg/g for goat and rabbits, respectively. These features make rabbits to be more preferred as an important protein source. Especially, in the circumstance that is facing all over the world that is climate change, which negatively affects the animal production sector that represents 37.5% of the agriculture sector in Egypt (FAO, 2020).

As proved from the previous studies, commercialization of the agriculture sector has a significant role in increasing farmer's income. However, micro-livestock such as rabbits did not receive the required attention in shifting them from small scale to industrial scale (Mensah *et al.*, 2014). The difference between the two scales is the target of rabbit farming. In small and medium scales, farmers are rearing rabbits as a multipurpose animal. They sell rabbits in the markets to save some cash income and provide the family needs of meat. Meanwhile, industrial level is working on increasing rabbit meat production to cover market demands of meat (Lebas, 2009). Therefore, to develop rabbit farming into industrial scale, it should develop the skills of small holders first, because small scale rabbit production is the most important and favorable economy in developing countries (Finzi, 2000 and Oseni and Lukefahr, 2014).

Therefore, the aim of this review is focusing on the status of rabbit production in Egypt, what are the obstacles and challenges facing rabbit production in Egypt. Furthermore, how can maximizing rabbit production in Egypt to reach to industrial level.

Current status of rabbit production in Egypt

Native rabbit breeds in Egypt

Since a long time ago, breeding program for native breeds has been established in 1932 at Faculty of Agriculture – Cairo University. In 1937, breeding procedure started to get breed characterized with higher growth rate and litter size (**El-Khishin *et al.*, 1951**). Nevertheless, this breed was having lower productive performance compared with Chinchilla and Giant Flander rabbits (**Khalil, 2002**). However, they are adapted to Egyptian climatic conditions.

Galal and Khalil (1994) carried crossbreeding between Flemish Giant and native rabbit breeds for several generations. They get new one called Baladi rabbit with three coat colors; black, red and white. The Gabali breed is raising by the Bedouin for meat production. Two projects were established to describe the genetic features of Gabali rabbits, the first one was in 1992 that carried by Desert Research Institute. The second one applied by Faculty of Agriculture – Benha University in 1994 (**Khalil, 2002**). In 1996, Faculty of Agriculture, Alexandria University carried crossbreeding between V-Line and Black Baladi to get Alexandria Rabbits. Moreover, in 2006 a crossbreeding between V-Line and Saini Gabali rabbits have been done for several generations to get new line called Moshtohor rabbits (**Iraqi *et al.*, 2008 and 2010**). After that, in 2009, a new line named APRI rabbits have been created by researchers team belongs to Animal Production Research Institute (APRI). The crossbreeding lasted for three generations to get this new line. Besides that, **Abdel-Kafy *et al.* (2011)**, introduced for the first time the NMER rabbits in The 4th Egyptian Conference of Rabbit Sciences. The NMER refers to the Native Middle Egypt Rabbits. The authors made a survey of the native rabbit populations in three governorates; Fayoum, Menia and Beni-Sweif, the characterization of NMER was done according to method described by **Khalil (2010)**. Recently, a crossbreeding between NMER and Giant Flinder rabbits has been carried out by researchers team belongs to Animal Production Research Institute, which lasted for 4 years (2016-2020). They get new line named with Egy-Line that proved its superiority in productive performance than that in parents as confirmed by **Abdel-Kafy *et al.* (2021)**.

Therefore, there is a clear diligence in the field of producing new rabbit lines and working to improve these local lines. However, we need to improve the environment for rabbits first, which is no less important than improving the productivity of local lines. Especially, since rabbits are among the most sensitive animals to environmental conditions.

Rabbits stock in Egypt

According to **Statista (2022)**, rabbit stock in Egypt obviously fluctuated with no clear trend may be due to the economical and managerial situations. It was decreased gradually from 6.16 (in 2010) to the lowest value of 3.45 million head (in 2014). Thereafter, it was increased again to highest value 7.11 (in 2017). Then decreased surprisingly to 4.45 without any interpretation, inspite of increasing of animal protein demand (Table, 1). Concerning rabbit does, their number elevated from 6591 to 7300 doe during the period of 1990-2010, respectively. In addition, Egypt consider the largest African country in rabbit does number in comparison with Algeria, Kenya, Rwanda and Cameron (**FAO, 2011**).

The majority of rabbit stock are in the hand of small holders, they raise nearly 90% of the rabbits in Egypt, using one buck with 8-10 doe. The farmers bred rabbits as backyard farming using small units such as cages or hutches. These small units were used in both villages and small towns. Actually, by introducing projects that supporting rabbit smallholders, will provide opportunities to increase family income **Ashour and Abdel-Rahman (2023)**. Additionally, provide a cheaper protein source for family consumption. Also, these rural projects are considered as a chance to enhance women empowerment, especially that, Egypt is the largest country in Africa in rabbit production by women (**FAO, 2011**).

Table 1. Rabbit stock in Egypt during the period of 2010- 2019

Year	Million Head
2010	6.16
2011	5.25
2012	4.72
2013	4.60
2014	3.45
2015	6.50
2016	6.17
2017	7.11
2018	7.00
2019	4.45

Source: Statists (2022).

Geographical distribution of rabbit farms in Egypt

According to the data of **El-Sheshtawy et al. (2021)**, the average of rabbit farms in Arab Republic of Egypt is 241.8, during the period of 2014-2018. The

majority of rabbit farms (202.4 farm) are found in the lower Egyptian governorates. These farms represented 84.5% of the total rabbit farm numbers in Egypt, during the period of 2014 – 2018. This could be attributed to the suitable climatic conditions and close to the main markets in this region. El-Sharkia governorate was the highest in the number of rabbit farms. That contains 52 commercial farm and represented 21.5% of total number of rabbit farms in Egypt, followed by El-Gharbia governorate (37 rabbit farm) that represented 15.2% of rabbit farm numbers. The third, fourth and fifth governorates were, Qalyobia, Dakahlia and Behaira, respectively (Table, 2). The lowest average of rabbit farm numbers (during 2014-2018) was found in North Saini that having only one farm in 2014 and 2015. After that, no rabbit farms were found in North Sinai. In the same line, El-Monofia and Port Said, were having 2.4 farm during the same period. In elsewhere, Middle Egypt governorates, Beni-Sweif, Fayoum and Menia, were higher in rabbit farm numbers than that in Upper Egypt governorates (Table, 2). Indeed, no rabbit farms were established in the governorates of South Sinai, Red Sea, Sohag and Luxury until 2018.

Table 2. Average of rabbit farm numbers in some Egyptian governorates during the period of 2014 – 2018

Governorate	Rabbit farm numbers	Average % of total rabbit farm
Lower Egypt		
El-Sharkia	52	21.5
El-Garbia	37	15.2
Qaliubia	35	14.6
Dakahlia	24	9.9
Behaira	17	7
Middle Egypt		
Beni-Sweif	5.6	2.32
Minia	2	0.83
Fayoum	1.6	0.66
Upper Egypt		
Assuit	2.6	1.08
Qena	1.6	0.66
Aswan	0.8	0.33

Source: El-Sheshtawy *et al.* (2021).

Rabbit's meat production

Globally, rabbit meat production increased from 1998 to 2017 by 85% (Trocinio *et al.*, 2019). At continent level, Asia was the biggest in rabbit meat

production (data $\times 1000$ tons), produced 325 tons and 1.088 tons in 1998 and 2017, respectively. In addition, the rate of increase over the same period was +235%. Africa is as ranked the second one, produced 73 tons of rabbit meat in 1998 with slight increase 88 tons in 2017 and with + 21% in production level. Meanwhile, both Americas and Europe recorded a reduction in rabbit meat production which was – 19% and -25%, respectively, over the period of 1998 – 2017 (FAO, 2019).

As for Egypt, the number of slaughtered rabbits for meat production increased from 6500 head in 1971 to 58286 head in 2020. These increases in rabbit meat production may be attributed to slight increase in awareness of the high potential of meat rabbit production and its positive impact on family welfare. In 1990, rabbits produced 49020 tons and increased to 54600 tons in 2010 (FAO, 2011).

In 1998, Egypt ranked the as fourth country in meat production produced 54000 thousand tone with share percent of 6.7% comparing with China, the biggest rabbit meat producer. China produced 308.000 tons in 1998 with share percent of 38.4%. Followed by Spain and France, both produced 129.000 (16.1%) and 76.000 tons (9.4%), respectively. After that, in 2017, China was keeping the first rank, producing 932.000 tons (sharing 62.9% of total rabbit meat production,

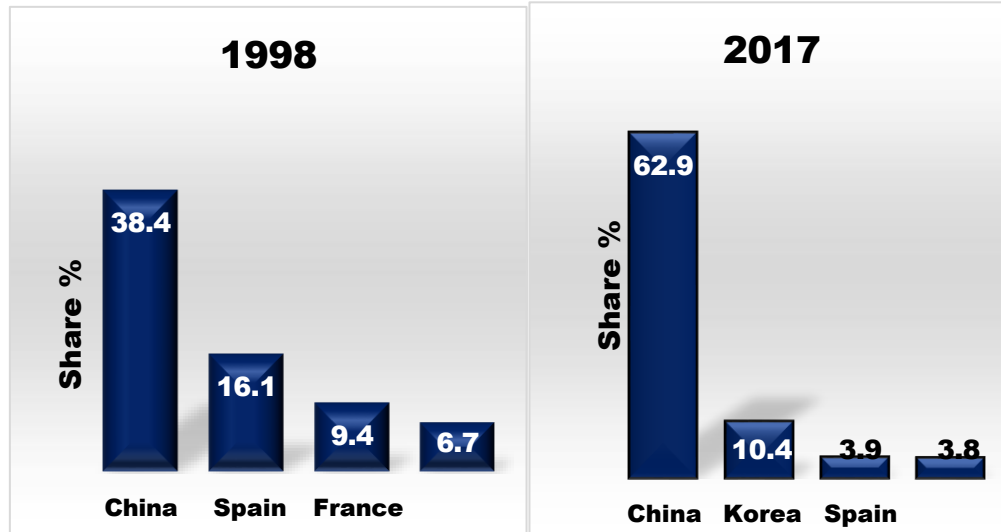


Fig. 1. Share percent of Egypt in rabbit meat production at global level during 1998 and 2017

While, Korea succeeded in elevating its production level from 1.6% in 1998 to 10.4% in 2017, to be the second country in rabbit meat production (Trocinio *et*

al., 2019). Spain was the third one, produced 57.000 tons, which was lower than that recorded in 1998. Egypt was still keeping the fourth rabbit meat producer, but with lower share percent (3.8%) than that in 1998. Because, countries such as China and Korea increased their production level especially Korea, increased from 13.000 to 154.000 tons of rabbit meat in 1998 and 2017, respectively (FAO, 2019).

In 2020, Egypt produced 37.000 tons (FAO, 2022) that was lower than that recorded in 2017. This may attributed to increased rabbit stock in 2017 than other following years. A comparison between amounts of meat production from rabbit with other livestock in the year of 2020 in Egypt are illustrated in Table (3). Unfortunately, despite of numerous of nutritive values of rabbit meat (low fat and total cholesterol content, good source of vitamin B and rich in sodium and

Table 3. Livestock meat production in Egypt in the year of 2020, based on the data of FAO (2022).

Species	Meat production (tons)
Poultry	3,995
Bovine	2,511
Cattle	730
Sheep	226
Rabbit	37
Lambs	25
Goats	14

phosphorus) its consumption comparing with the other meat sources is minor.

Rabbit profitability in Egypt

There is lack in studies that focusing on the economics of rabbit production in Egypt. But, in 2021, El-Sheshtawy *et al.* carried an economic study to evaluate rabbit production profitability in Egypt in comparison with poultry and animal production. They found that, in the year of 2018 animal production achieved 187.6 billion Egyptian pound that presented 37.5% of total agricultural sector. While, poultry production recorded 46.8 billion, presented 25% of the agricultural sector. Hence, the increased demand of red meat and the inability of local production to meet the required demand. This led to provide animal protein from rabbits that are the best alternative to red meat. This caused to increase the value of rabbit production in Egypt from 0.26 billion Egyptian pound in the year of 2000 to 2.5 billion in 2018 (Fig, 2). That represented 0.5%, 1.33% and 5.34% of agricultural production, animal and poultry production, respectively. In the year

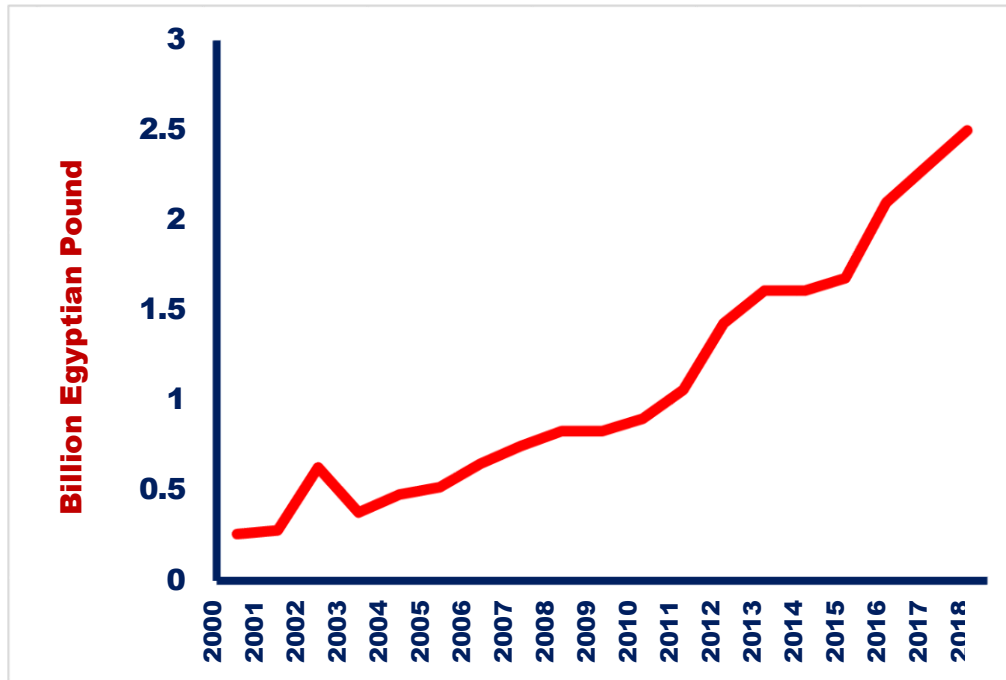


Fig. 2. Profitability of rabbit production in Egypt during the period of 2000-2018

of 2000, rabbit meat production presented 1.19% and 7.52% of animal production and poultry production values, respectively. In 2002, rabbit production recorded its highest percentage, 10.12% and 2.15% of total poultry and animal production, respectively. That was higher than that recorded in the year of 2018 (considered the lower share percent of rabbit production through years 2000-2018).

In general, the annual increase of rabbit production in Egypt is 0.12 billion pound with annual elevation rate 10.7%.

Challenges of rabbit industry

1. Environmental stressor

The environmental constrains (especially, heat stress) are the most important factor that impair the productive and reproductive performance of rabbit in Egypt (**El-Raffa, 2004**). Normal temperature of rabbit's body ranged between 38.5- 39.5°C, and the optimal environmental temperature for rabbits is 15 – 25°C and 55 – 65 % for humidity. When temperature rises to 30°C, rabbits will suffer from heat stress and they lose their ability in regulating their body temperature. It causes decrease in daily weight gain about 20-25%, 8-15% for feed conversion ratio (FCR), elevating mortality rate by 9-12% and reduces

reproductive performance by 6-10%. **Rashwan *et al.* (1997)** as compared to pre- and post weaning growth performance in New Zealand White rabbits, Baladi Red, Baladi Black rabbits during summer season in Egypt. They recorded lower average daily gain and attributed these results to heat stress and low diet quality. By reaching to 35°C, it will cause abortion in pregnant does because heat stress lead to insufficient blood supply to uterus, that negatively affect fetal growth and become smaller and finally fetus mortality rate will rise. Rabbit bucks, are more sensitive to heat stress than female. They suffer from infertility for 45- 70 day in hot conditions. In addition, the ejaculate volume decreases by 80%, due to the changes in biochemical and physiological reactions in the testes **Fig. (3)**. Which, lead to a disturbance in antioxidant system and changing in testis microenvironment. (**Marai *et al.*, 2002; Durairajanayagam *et al.*, 2015; Daader *et al.*, 2016; Marco-Jimenez *et al.*, 2017 and Liang *et al.*, 2022**).

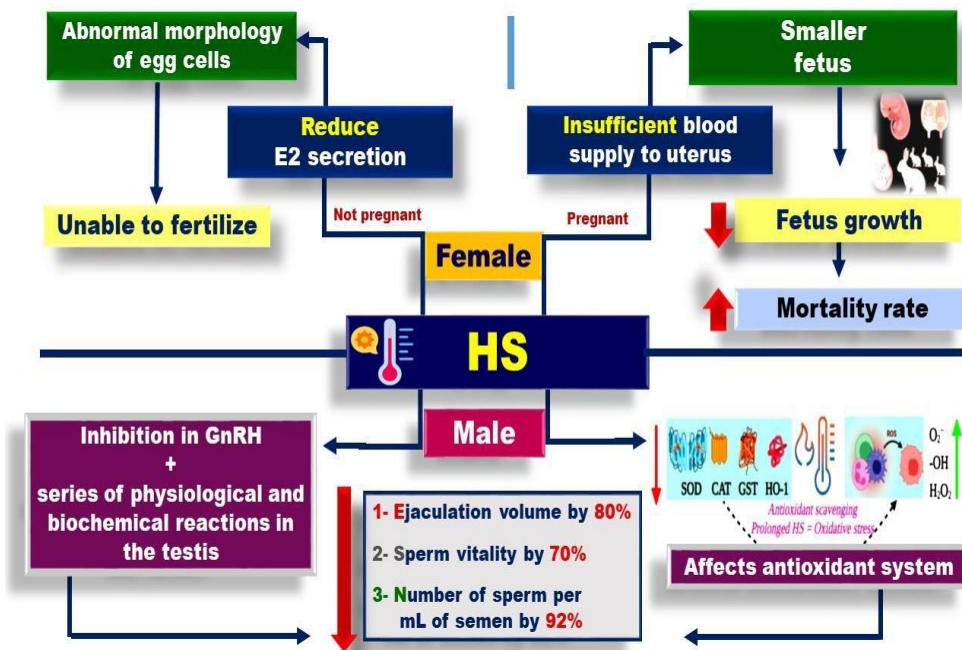


Figure 3. Impact of heat stress on both male and female productive performance of rabbits.

Therefore, in the upcoming climate change, rabbit will need a special attention and more applied researches to help them to be more productive and more

tolerant to the hottest conditions. In the same line, providing the guide lines for small holders in mitigation strategies for heat stress and supplying rabbits with suitable diets.

2. Limited institutional framework to support smallholders

There is an urgent need to develop policies and governmental support for smallholders of rabbits. Especially that, in previous studies, **Zeising (2000)** and **Clavel *et al.* (2004)** confirmed that farmers that having small numbers of rabbits can develop the system of keeping rabbits in spite of absence of technology and technical assistance. This already confirmed by **Ibrahim *et al.* (2000)** who compared between small (each breeder having three rabbit does) and large rabbit units in Egypt. After one year of their study, they found that kindling rate/doe/year was 6.74 in small holders vs. 5.66 in large units. In addition, mortality rate (from birth to weaning) and weaning weight (at 30 days) were 14.9% and 573g for smallholders vs. 24.8% and 512 g for large units, respectively. In addition, they found that, farmers were insist to improve themselves to maintain their production level. Therefore, the small rabbit units could be effective if they receive the required attention and assistance.

There is an urgent need to strength the link between scientific research and rabbit production to achieve the sustainable development in rabbit farming at small scale. Because, this link will help in providing the essential knowledge for rabbit farmers.

Previously, several projects in Egypt were working on promoting rabbit farming in the rural areas **Ashour and Abdel-Rahman (2023)**. For example, the cooperation between Zagazeg University and the Egyptian Academy of Scientific Research and Technology. This project aimed to supply rabbit farmers with the purebred of New Zealand White rabbits and California rabbits (**Gala and Khalil, 1994**). In addition, the National Development Agricultural Bank and United States Agency for International Development (USAID) were introduced loans to smallholders in rural area (**Oseni and Lukehahr, 2014**). In 1990, **Kamel and Lukehahr** recorded remarkable successes in a project applied in Ezbat Bader that funded by Near East Foundation, this project succeeded in reducing youth migration to urban areas. The most important goal is, lifting up rabbit production into industrial scale will not cause harmful effects to environment, because rabbit is considered a friend to the environment as mentioned previously.

The most important point is, role of researcher in developing rabbit production at small-scale level, and their researches should be involved in solving farmer's problems. Many authors (**Bang, 1999; Lukehahr 2000 and 2007**) called the researchers to direct their work to the priorities that needed to develop rabbit production and transfer the expertise to small-holder. **Conroy *et al.* (2002)**

and Oseni (2008) stated that, accountability of researches (in Africa) to achieve rabbit production targets are not exist, and about 80% of their publications were considered as basic research. This classification was building on the finding of **Morand-Fehr *et al.* (2004)**, who developed score for applicable research from zero to 3. The score zero refers to, no possible research application. The score one implies to eventual research application, but after carrying out other experiments. The score 2 denotes that research has possible application, and 3 refers to the research can be applied to small-holder and will be suitable for their conditions. Unfortunately, most of publications in Africa in the field of rabbit production were fallen within zero to one as mentioned by **Oseni and Lukefahr (2014)**. Therefore, the researchers themselves need; 1- support, motivation and rewarding those who publish searches can apply by smallholders. 2- Provide them financial support to help them to carry out their experiments. So, that help researchers to make their work more applied.

3. Consumer attitude toward rabbits meat

When consumption rate of different type of meat was counted. It observed that poultry meat took the first place followed by pork then beef meat (**Fig., 4**) based on the data mentioned by **Siddiqui *et al.* (2023)**.

For rabbit meat consumption, the world consumption is estimated to be 0.19 kg/ year/ capita, in 2020. Table (4) showed that the most countries that consuming rabbit meat, but, there were not available data about its consumption in Egypt. If we compare rabbit meat consumption with other types. It seems that, rabbit meat is consuming at very low level. Because, there is a segment of consumers that are dealing emotionally with rabbit meat, and see them as a pet. Moreover, those who consume rabbit meat do not eat it more than three times per year (**Siddiqui *et al.*, 2023**).

Table 4. World rabbit's meat consumption per capita in the year of 2020

Country	Consumption (KG)
Korea	6.81
Czech	3.74
Spain	1.09
Italy	0.91
China	0.61
European Union	0.51
Egypt	??????

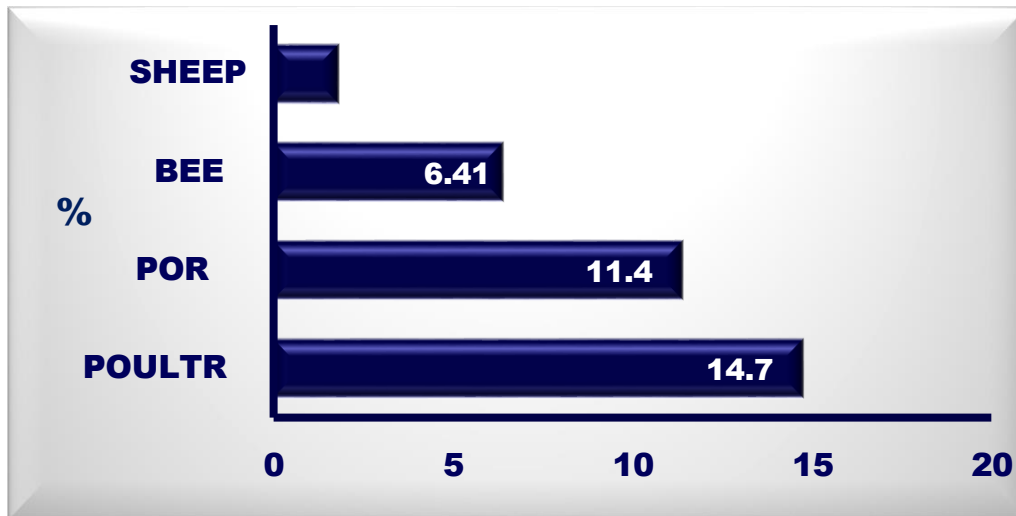


Figure 4. Consumption rate of different meat type during 2020 (Data adopted from Seddiqui *et al.* (2023))

Practical consideration

A. To develop rabbit production it should building well defined goals and developing the way of training rabbit farmers. Actually, it should follow small-scale rabbit project model (SSRPM). That firstly proposed by **Lukefahr (2004)** in the 8th World Rabbit Congress and proposed again in 2007. The author assured on the importance of using this model by rabbit scientists to develop rabbit production. The SSRPM, is consisting of three main factors (**Fig., 5**):

1- Internal factors: refers to production components such as rabbit feeds, implementation (starting rabbit project), housing, and equipment

2- Intermediate factors: such as, feasibility, which means

- Could we create a specific market for rabbit meat?
- Are the farmers knowing the basic information about rabbit farming?
- Did the culture of rabbit farmers forbade the visit of male expert to the house where women raised rabbits?
- Did the farmers are already convinced of rabbit project idea or they establish this project due to the idea imposing by someone else?

Also, intermediate factors refers to monitoring the project: the expert should prepare a questioner list to rabbit farmers for example:

- Are rabbits in good health?
- Availability of fresh water
- The born kits are growing well or there is high rate of mortality rate?

- How they handle with rabbit manure, is it recycled in the farm or not?
- Are farmers using recording system
- Are there adequate shelters and what about its safety?

Lukefahr (2007) illustrated that, the intermediate factors are very important to be considered when establishing rabbit project.

- 3- External factors:** reflect the economic, sociological and ecological factors. The economic factors which refers if there is sufficient capital to start rabbit project? While, the ecological one, is concerning about if the farm resources are conversed or not? The sociological one is dealing with, if the farmers are in regular meeting or not? Are farmers helps the others and provide them their exportation?

B. Providing efficient training for smallholders

Developing the proficiency of rabbit smallholders and maximizing their management skills is a fundamental step in enhancing rabbit farming and lifting up into industrial scale. The lofty goals could be achieved by providing smallholder s the suitable and efficient training in different objects in rabbit management including housing, nutrition health care, and farm hygiene and how they deal with the problems, they face. Besides training, farmer's conscious to develop themselves and improve their production is an important factor to success their rabbits project. Training should be in tandem not intensive training over several days, by teaching one lesson followed by practical parts and different fields (**Lukefahr, 2007**).

In the field of nutrition

Judgment on feed quality is depending on protein level and if it is digested well or not? (depending on level and composition of amino acids) and amount of fiber in the diet. Feeding strategies should be based on 1- Rabbit requirements in each stage (weaning, pregnancy, not pregnant, lactation and mature buck). In general rabbit need 10% digestible energy, 16% crude, 11.5 digestible protein, 15% crude fiber, 0.22% sodium, 15,00 IU Vit.D/kg diet, 10.00 IU Vit. A, and 1.10% calcium, could be reduced to 0.8% for growing (**Lebas, 2013**). **For feeding behavior**, several point must highlight for smallholder in rabbit feeding such as:

- 1-** Rabbit spend about 10% of 24 hours of the day in feeding pellets. While if the feed is presented a meal this time will be multiplied by 1.5 to 2.
- 2.** Each rabbit spend 5-10 second to take the feed from the feeder then remove his head to chew for about 0.5 – 1.0 minute, then return his head to the feeder again.

3. Smallholder must know they can feed their stock during heat stress. Because increasing temperature to 30°C will reduce feed intake, and in this case supplying feeds should supply with lipids. For example, essential oils could be added about 300 mg/kg diet for heat stressed rabbits. The essential oils were found to increase sperm viability, testosterone concentration and reducing MDA level (**Liang *et al.*, 2022**). Also, during heat stress, rabbit farmers should know the correct time of introducing feed, besides that, introducing cold water during the hottest hour of the day.

4. Feeding on concentrate are more favorable for rabbits than fibrous diets. However, fiber is important in rabbit feeding, because fiber that consumed at small quantities may reduce growth rate and lack of fibers caused digestive disorder and increasing fiber level may cause reduction in growth rate and (**Lebas, 2013**).

5. The amount of consuming dry matter intake is depending on the physiological status of the rabbits. If rabbit doe is not pregnant, they consume about 3.55 of her body weight. This percent increased to 8-9% if the doe is at her peak of lactation (**Lebas, 2013**).

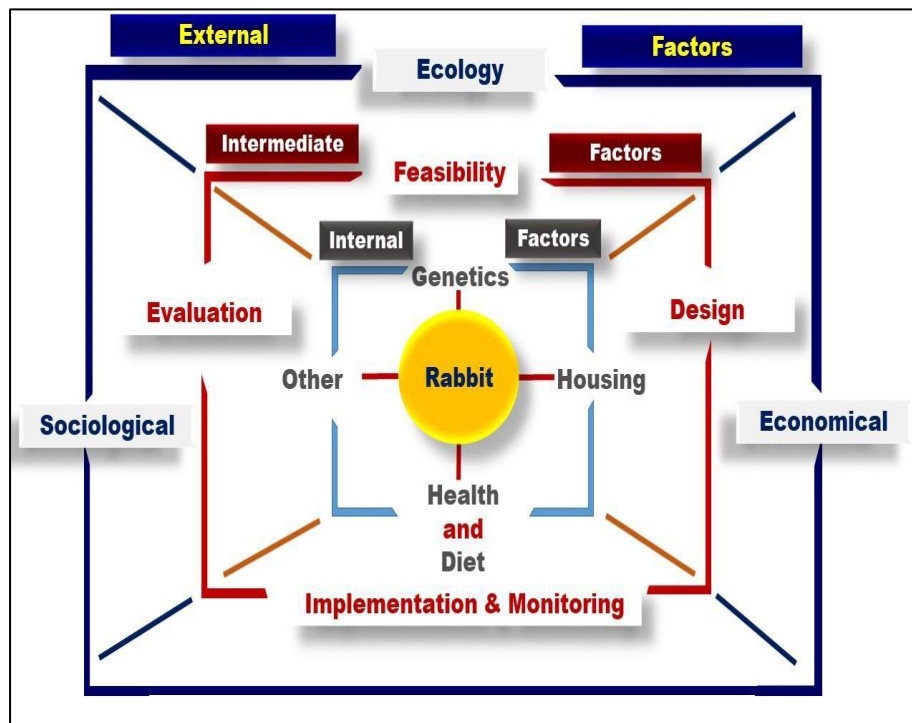


Figure 5. Wheel of rabbit production sustainability as suggested by **Lukefahr (2007)**

In the field of health care

Smallholder's information about health care for rabbits are still in challenge. The rabbit farmer should be informative about time of vaccines to protect rabbits from infections. They also know how to clean rabbit feeders, cages and all about hygiene level for each pen. They should notice any abnormalities appear in rabbit's body of behavior. Moreover, cages should be safe, and rabbit must not be crowded to prevent any harmful injuries.

In the field of housing

Rabbit housing is important factor that influencing their productive performance and welfare. The provided space for each rabbit, floor type, group size, all such these factors must be calculated carefully when rabbit house is design.

Concerning the allowed space for each rabbit, **Morisse and Maurice (1997)** and **Trocino et al. (2004)** reported that, higher stocking density resulting in reducing feed intake. Because, **El-Bayoumi et al. (2018)** noticed that, rabbit reared at 28 rabbit/m² have lower body weight than that reared at 12 or 20 rabbit/m². The suitable stock density is 15-16 rabbit/ m² as confirmed by **Krunt et al. (2020)**. Providing the suitable space for each rabbit will reflect on meat production, **Dalle Zotte (2009)** and **Matics et al. (2014)** cleared that, when a single rabbit have bigger space will give a chance to run more then his body weight will reduce leading to lower carcass weight and dressing percent. **Loponte et al. (2018)** stated that, rabbits reared in cages have higher carcass weight than that reared in outer doors. Because, in outer doors rabbits consumed more energy in jumping and running, thus their body weight reduced.

In the same line, type of floor is important factor that effects rabbit body weight. **Gerencser et al. (2014)** found that, rabbits reared on plastic-mesh floor gained more body weight than the rabbits reared on wire-mesh or deep litter. Similarly, **Trocino et al. (2015)** found, that rabbit body weight, feed intake and live body weight were greater in plastic than the wooden slatted one. Indeed, this information must delivered to smallholders in simple and accurate way to be aware about the correct methods in rabbit management.

After applying training, let farmers to purchase rabbits (ex. 5 does with one buck) and not providing them free. Because, this will make farmers to value and appreciate the purchased rabbits. In addition, it is better to supply farmers with rabbits at age 3 months; because rabbit will have the chance to adapt to the new environment then they will be ready for breeding when they reach to breeding age (**Lukefahr, 2007**).

C. *Establishing smallholders network*

This step has a greater positive impact in developing rabbit farming at small-scale level and help them to transit their level to industrial level. Because, this step will help in sharing the experience of each stakeholder and promoting the knowledge of rabbit management and welfare at backyard system. In the same line, this network will help in solidarity creation between smallholders that helps in improving and secure farmers situation. In this case, rabbits will play an important role in achieving lofty goals that previously mentioned (**Oseni and Lukefahr, 2014**). There was a success story made by France farmers, in 1981 a group of 3 rabbit farmers worked together with one technician. In their first year, reared 3200 rabbit does and sold 176.000 for slaughtering. In 2008, this group contained 220 rabbit farmers, raising 135.000 rabbit does with production volume 7.5 million for slaughter, reaching to 10.5 million in 2009. The enterprise of rabbit French farmers hired 45 employees, establishing artificial insemination, slaughter house and commercialization unite. The success of this enterprise is related to the group cohesion and economic situation of France. However, Egypt recorded success story by smallholders that previously mentioned by **Ibrahim et al. (2000)**, where the small farmer has proven his ability to success compared to the large units.

Additional required steps should be taken which is, supporting rabbit meat producers via establishing association for them just as the Philippines do. The Philippines established their association in 2015 named with Association of Rabbit Meat Producers. This organization aims to increase the awareness of Philippine people about rabbit production as a viable source of income and to popularize rabbit meat as alternative source of protein and good nutrition (**Paladan, 2022**).

D. *For consumer attitude toward rabbits meat*

We need to create more studies about consumer's attitude towards rabbit's meat in Egypt. Furthermore, rabbit meat should provide in new way. As processed meat because, some consumers become afraid when seeing the whole rabbit carcass and seeing the rabbit's head in it. Besides that, make diversification of the introduced product of their meat, trying to satisfy consumer taste.

In conclusion, lifting up rabbit production to industrial scale will require years not months. This need to focus on smallholder's objectives and helping them in expanding their goals and that requires the following:

1- From researchers

- Establishing national recording system for rabbits
- Establishing network that link rabbit breeder with each other

- Efficient and detailed training for smallholders and applying the wheel of rabbit production sustainability suggested by **Lukefahr (2007)** especially the intermediate factors, because these factors are the vital point in developing rabbit production
 - Establishing gene bank
 - Applying reproductive biotechnology
- 2-From breeder:** they must be hard worker, patient and to benefit as much as possible from the training given to them. To be well qualified and expand their objectives to reach to main point which is maximizing rabbit production in Egypt.

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الوضع والتحديات الحالية لرفع إنتاج الأرانب في مصر إلى المستوى الصناعي

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تتميز الأرانب لأدائها الإنجابي العالي ، حيث يمكنها إنتاج بمتوسط ٤٠ من الخلفات سنويًا. علاوة على ذلك ، لحوم الأرانب تحتوي علي مستوى عالي من البروتين وإنخفاض متواه من الدهون والكوليسترول. في البلدان النامية ، مثل مصر ، يتم تربية الأرانب لتلبية احتياجات الأسرة من البروتين وتوفير بعض الدخل النقدي للأسرة. لسوء الحظ ، أدى ذلك إلى انخفاض القيمة الاقتصادية للأرانب ، لأن أكثر من ٨٠٪ من إنتاج الأرانب في أيدي صغار المربين، وقد لا يكون بعضهم مؤهلاً جيدًا لتربية الأرانب. يدعو الوضع الحالي (من حيث زيادة التعداد السكاني مع زيادة الطلب على البروتين الحيواني والتغير في الظروف المناخية) إلى رفع كفاءة إنتاج الأرانب وتحويلها إلى نطاق كبير أو صناعي. وهذه الخطوة تتطلب من هؤلاء المربين الصغار تغيير وتوسيع أهدافهم في تربية الأرانب.

التوصية: ان هذه المقالة المرجعية سوف تركز علي الوضع الحالي لإنتاج الأرانب في مصر ، مع الإشارة إلى العقبات التي تواجه إنتاج الأرانب. وأيضاً دور الباحثين في إرشاد وتدريب صغار المربين على تربية الأرانب ، وما يحتاجه هؤلاء المربون ليكونوا مؤهلين تأهيلاً جيداً في إنتاج الأرانب. محاولة زيادة إنتاج الأرانب إلى الحد الأقصى ورفعها إلى المستوى الصناعي.

الكلمات الدالة: تعداد الأرانب ، إنتاج اللحوم ، صغار المربين ، المستوى الصناعي