**Eggs: harnessing their power for the fight against hunger and malnutrition**

**Collection of contributions received**

Table of Contents

Topic note 4

Contributions received 6

1. Gerhard Flachowsky Federal Research Institute for Animal Health, Germany 6

2. Dick Tinsley, Colorado State University, United States of America 6

3. Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria 7

4. John Cheburet, Radio Producer and Agriculture Content Creator, Kenya 8

5. Cedric Charpentier, WFP, Italy 9

6. Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria 9

7. Kuruppacharil V. Peter, Kerala Agricultural University, India 9

8. Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom 9

9. Mary Odusegun, NPOWER AGRO, Nigeria 11

10. Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria 11

11. Cedric Charpentier, WFP, Italy 11

12. Bonphace Mangeni, Masinde Muliro University of Science and Technology, Kenya 12

13. Hélène Delisle, University of Montreal, Canada 12

14. Wilma Freire Zaldumbide, Universidad San Francisco de Quito, Ecuador 12

15. Christian Ciza, Democratic Republic of the Congo 13

16. Teopista Mutesi, FAO, Rwanda 14

17. Vethaiya Balasubramanian, Freelance Consultant, India 14

18. Wajid Pirzada, Roots Pakistan, Pakistan 15

19. Akhila Vasan, GMA Science and Education Foundation, United States of America 15

20. Tim Lambert, International Egg Commission, Canada 16

21. Peterson Kato Kikomeko, Kyambogo University, Uganda 17

22. Max Blanck, FAO, Italy 17

23. Kazungu Rauben, Makerere university, Uganda 17

24. Lawrence Matolo, Machakos University, Kenya 17

25. Olutosin Otekunrin, Federal University of Agriculture, Abeokuta, Nigeria, Nigeria 18

26. Santosh Kumar Mishra, Population Education Resource Centre (PERC), Department of Continuing and Adult Education and Extension Work, S.N.D.T. Women's University, Mumbai, India 20

27. Rose Hogan, Trocaire, Ireland 23

28. Brandon Eisler, Nutritional Diversity, Panama 23

29. Dick Tinsley, Colorado State University, United States of America 25

30. Jesper Møller Nielsen, R2 Agro, Denmark 25

31. Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom 26

32. Tim Lambert, International Egg Commission, Canada 26

33. Peter Kingori, Turnsbridge Analytica, Kenya 27

34. Mahesh Chander, Indian Veterinary Research Institute, India 28

35. Hart Jansson, Malnutrition Matters, Canada 28

36. Colleen Farrell, CARE, United States of America 29

37. Jean-Laurent Bungener, France 30

38. Mohamed Salih, Sudan University of Science & Technology, Sudan 30

39. Stella Kimambo, FAO, United Republic of Tanzania 31

40. Taylor Wallace, Think Healthy Group, Inc., United States of America 32

41. Sarah Wanene, Agrinovations Enterprises, Kenya 32

42. Olutosin Otekunrin, Federal University of Agriculture, Abeokuta, Nigeria, Nigeria 33

43. Abdou Yahouza, CLUSA Projet sécurité alimentaire ARZKI, Niger 34

44. Tim Lambert, International Egg Commission, Canada 35

45. Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom 35

# Topic note

Dear all,

In spite of the increasing prevalence of obesity and non-communicable diseases, undernutrition remains a critical issue for many of the world’s poorer countries. In each of Eastern and Southern Africa, Western and Central Africa, and South Asia, more than a third of children are stunted. In fact, nearly 151 million children under five in the world were still stunted in 2017. For many of these children, the poor growth which will blight their entire lives began in their mothers’ wombs. Poor quality food is one major contributor to poor growth both in the womb and during the vulnerable first years of life. But which foods should we be promoting to make a difference to these figures? And how should we go about making the most nutritious foods accessible to world’s poorest populations?

The humble egg seems increasingly likely to offer a practical and impactful opportunity to tackle these problems. Eggs are almost pure protein, of very high quality. They also provide virtually the entire Adequate Intake, for young children, of vitamin B12 and choline. The essential fatty acid content of eggs may be especially important in pregnancy. Nearly the whole world - with the notable exception of the vegetarian belt of India - likes to eat eggs, and they can be produced at prices which make them accessible even to the moderately poor.

Since the publication of a landmark trial last year (Iannotti, 2017), we have known that daily consumption of eggs can markedly improve the linear growth of young children. The journal Maternal and Child Nutrition has now published a special supplement (<https://onlinelibrary.wiley.com/toc/17408709/2018/14/S3>), which summarizes a wealth of additional information on the value of eggs and feasible ways of increasing access.

The first paper provides an overview of the role of eggs in the diet of maternal and child nutrition and updated data on egg consumption (Lutter et al., 2018) while the second summarizes how social marketing was used in a randomized controlled trial of eggs early in the complementary feeding period to foster high compliance, as well as empowerment of participants and policy change in Ecuador (Gallegos-Riofrio et al., 2018).

The third and fourth papers examine how a controlled intervention to foster poultry production affected child dietary diversity and nutritional status in Ghana (Marquis et al., 2018) and Zambia (Dumas et al., 2018) while the fifth paper reviews successes and lessons learned from a project on small-scale poultry production to increase egg production and household egg intake in four diverse African contexts (Nordhagen & Klemn, 2018).

A novel approach to use chicken eggshells to improve dietary calcium intake in rural sub-Saharan Africa is reported in the sixth paper (Bartter et al., 2018), while the seventh paper reports on business models for poultry production in East Africa and India (Beesathuni et al., 2018).

The multiple roles, systems and challenges and options for sustainable poultry production through a Planetary Health lens are reviewed in the eighth paper (Ayers et al., 2018) and the supplement closes with a paper on how universal access to eggs might be achieved through large scale poultry production (Morris et al., 2018).

Taking advantage of these latest studies, we would like to invite you to join a discussion around this important topic. Your experience and knowledge will be of great value to operationalize the findings and to raise awareness of the role that eggs can play in the fight against hunger and malnutrition.

1. In order to increase access to eggs for the world’s poorer populations, what should be the right balance between small-scale production, large-scale commercial production, and long-distance trade? If countries do increasingly move towards large-scale production, how do we balance the interests of better nutrition with concerns about smallholder livelihoods?
2. What are the different ways that we could increase demand for eggs, other than increasing availability and reducing price? What are some examples of successful initiatives?
3. How can we mitigate the potential downsides of large-scale egg production on animal welfare and carbon emissions?
4. What do we need different stakeholders (governments; private sector; academia; normative agencies) to do to accelerate access to eggs in poor communities?

We hope that you will find this interesting and look forward to receiving your thoughts and comments.

All the best,

Saul Morris, Global Alliance for Improved Nutrition (GAIN)

Tim Lambert, International Egg Commission

# Contributions received

## Gerhard Flachowsky Federal Research Institute for Animal Health, Germany

Dear Colleagues,

I agree with you that eggs are very important sources of amino acids, energy and also some essential trace elements and vitamins.

Recently, we finished some dose: response studies with various Iodine supply in laying hens and found interesting results, which may be also very helpful to contribute to overcome Iodine-deficiency in many countries.

Attached, you will find a review of these studies. E.g. Table 7 demonstrates that one egg of hens fed with adequate I-supply may cover about 50% of the human Iodine-requirements.

See the attachments: [JodHenne17Landbau.pdf](http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/JodHenne17Landbau.pdf)

Best regards

Gerhard Flachowsky

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## Dick Tinsley, Colorado State University, United States of America

I recently attended a World Bank seminar/webinar on nutrition which was largely promoting the need for an egg a day to prevent stunting in infants and toddlers. I academic side was well done, but was it practical? I doubt it. Most smallholder farmers and other deeply entrenched in poverty are unable to afford or produce. Please visit the webpage: [http://smallholderagriculture.agsci.colostate.edu/integration-an-under-appreciated-component-of-technology-transfer/](http://smallholderagriculture.agsci.colostate.edu/integration-an-under-appreciated-component-of-technology-transfer/%20) where the example is used in a synthesized hypothetical case based on hard data from Angola, and also try working your way through the exercise on Hard Choice: Compromises in quality Nutrition and see if you can include the egg or sell the egg to acquire more energy to meet the dietary needs of you economic opportunity most likely based on heavy manual labor. The link to Hard Choices is: <http://smallholderagriculture.agsci.colostate.edu/1028-2/>

Thank you,

Dick Tinsley

## Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria

Stimulating Egg Demand through Upgraded Household-level Food and Nutrition Knowledge, Kano State Nigeria

Hello forum members,

Eggs are high potential food for improving maternal and child nutrition; that is if you know what it is, what it can do for you in terms of body nutrition and how to go about exploiting the egg potential. We are talking about egg and generally food knowledge and information something that is lacking among vulnerable household women who are mostly responsible for managing maternal and child nutrition at the household level in our part of the world.

One of the feasible options to increase egg demand particularly among grassroots communities in northern Nigeria; Sub Sahara West Africa is to intensify vocational training of household women on food commodities and nutrition. By tradition these category of women are shouldered with responsibility of feeding the family despite the fact that majority of them have little or none food and nutrition knowledge such that is required to make tangible impact. They don’t take good nutritional care of themselves, the babies, school children, adolescents and the aged in the family. There is a situation where head of the household is a poultry farmer producing eggs for sale only and not a bit of the egg is consumed in the household as it is mythically considered luxury that is meant only for the rich. Another sad story is of a rural-based pastoralist community that practice free-range poultry farming producing meat and egg with organic potential but they don’t consume the chickens and eggs, only to sell them while their pregnant women and underage children clearly move around with severe symptoms of chronic malnutrition. Both cases are clear testimony of food and nutrition illiteracy among grassroots communities which could be successfully tackled through learning by training. Training household women on how to differentiate egg recipes and diversify egg utilization especially for maternal and child nutrition holds significant promises for checking diet-related health conditions as well as improve business for upstream actors in the egg value chain.

Stakeholder involvement

Stakeholders such as GAIN et al. need to have direct connection with grassroots community effort in problem areas such as Kano state in Nigeria in order to provide constant guide that will align food and nutrition vocational training with national and international nutrition agenda. For example,

Food and Nutrition Vocational Center (FNVC) in Kano metropolitan is non-governmental not-for-profit adult education outfit that mobilizes household women most of them secondary school terminated and married with children now; train them on food entrepreneurship and organize them into food cooperative to promote community nutrition. Please see attached FEED program.

There are challenges but the success indicators are remarkable. Sustainable intensification of the successes is achievable by collaboration with government and agencies such as GAIN, SUN (scaling up nutrition) in areas of food cooperative management, next level nutrition training and community engagement to address maternal and child nutrition problems on wider scale.

See attachments: [FEED Program-1.pdf](http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/FEED%20Program-1_0.pdf)

Kindest regards,

Rabiu Auwalu Yakasai

Director

Food and Nutrition Vocational Center (FNVC)

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Gwale LGA, Kano State

Nigeria.

## John Cheburet, Radio Producer and Agriculture Content Creator, Kenya

Hello members,

I considered eggs (and beans) as accessible and affordable protein sources of protein for households, especially in rural areas where chicken are majorly kept in free-range or semi-free range systems.

Small-scale or large-scale really depends on the purpose of producing eggs; for home consumption or for the market. If for the market, then production must make economic sense to the farmer. In Nakuru and Western region of Kenya, the cost of chicken feed remains the biggest hindrance making local eggs unable to compete in the local market. For example, eggs from Uganda sells for as low as KSh 300 (USD 0.3), while eggs by local producers retail at KSh 340 (USD 0.34). The downside is quality. Consumers are not assured of quality bearing in mind the distances the eggs have travelled.

Local initiatives to tackle the feed cost issue include the use of locally available feed like sweet potatoes and cassava; foods that are largely shunned by people in favour of maize, rice and wheat. The tuber crops are planted off season have the primary maize crop has been planted. The available sweet potato varieties are drought tolerant and take shorter time – from 4 months. Even with this, protein sources for chicken feed remain expensive for farmers.

Indigenous and improved indigenous chicken breeds are popular with farmers, especially small-to-medium scale producers because they are hardy (resistant to diseases and can survive on locally available feeds), and they are they are dual purpose; kept for meat and eggs, something that farmers see as an advantage over the exotic breeds.

On increasing demand, finding creative ways to educate people on the nutritional benefits of eggs. I have seen farmers sell eggs to things like soft drinks for their children, which have lesser nutritional benefit compared to the sold egg. Together with this, in addition, increasing options for consume eggs at the home level makes is appropriate. At the moment, most households consume eggs as boiled or fried as a snack, used as a vegetable to accompany. For child nutrition, use with porridge or as an addition with other foods can increase demand and diversity of usage.

Generally, awareness creation and training of producers is the first level intervention to mitigate the downside of large scale production. This is factored into extension and advisory services as part of wider community development communication and outreach. Consumers can also contribute through buying of eggs from farms that treat their birds well. Consumer awareness through mass media tools like radio, television, agricultural shows and exhibitions, and now social media offer possible interactive and participatory channels. However, this can only happen where it is possible to trace the source of the eggs in the market. This can be handled through policy and enforcement at both national and county levels of government.

John Cheburet: Radio Producer, Nakuru, Kenya

## Cedric Charpentier, WFP, Italy

Where to start...

Those 9 articles do not teach us anything really new...

Not only are they not conclusive on the actual contribution of eggs to nutrition (what can be attributed to eggs vs. what can be attributed to SBCC?), they also show that egg production, unless done in an extensive manner, cannot really lead to cheap egg production, therefore to easy access for the poorest. This is rather convenient when the main partner for this discussion is one of the biggest lobby firm for the egg (and animal exploitation for food) industry.

Unfortunately, there is not much about animal welfare and on the tradeoff that the production of eggs on an industrial basis would mean for not only the environment but also for health. Let's not forgot the many scandals plegging the egg industry around the world and the number of people getting sick because of the need to produce always more.

Click on the link to the Canada International Egg Commission and check all their members... it is very telling on how eggs production need to make checking and their eggs (babies) a commodity that is fed with antibiotic and kept from seeing the light of day. Is this the model we want for Africa? Is this the model we want at all?

We can agree that egg provide important nutrients, but those can be found in many other non-animal based products that respect animals and the environment (to the exception of the B12 vitamin). So the real question here, knowing that eggs can only be made available to the masses through industrialization and commoditization of animals, do we really need eggs to fight hunger and malnutrition? Really?

## Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria

I am with Cedric point of view. Please don't drag innocent contributors to the forum into egg politics to make global winning views perhaps for a cornered business proposition elsewhere? I hope we are not ignorantly making good case for egg powder invasion of developing countries to the detriment of their natural egg potentials.

Rabiu Auwalu Yakasai

## Kuruppacharil V. Peter, Kerala Agricultural University, India

Eggs of hen, duck and quil are common in the diet of middle and above middle class people. Eggs are classified under non-vegetarian food. An egg a day is a desirable food item. The recent propaganda against poultry egg especially the red portion is quite discouraging. Consumption of egg will lead to increase in bad cholesterol and may facilitate cardio-vascular diseases. In 2013 Government of India passed the National Food Security Bill, which made access to food a legal right of the people. In states like Tamil Nadu, one egg was included in the mid-day meal scheme. The apprehension of people on use of poultry egg and heart diseases needs to be removed by educational tools. Recently I edited a book ZERO HUNGER INDIA:POLICIES AND PROGRAMMES published by Brillion Publishing New Delhi([info@brillionpublishing.com](info%40brillionpublishing.com)) carries roles of fish, animal meat etc. on NUTRITION SECURITY.

## Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom

Great to read all of the contributions this week.

**Gerhard Flachowsky [contribution 1, Ed.]** reminds us that by adding specific nutrients to chicken feed (in this case, iodine), one can increase the concentration of that nutrient in the eggs that the chickens lay. The concept has become familiar to consumers in some countries where DHA-enriched eggs are available for purchase. It essentially makes the egg a fortification vehicle, comparable, for example, to vitamin D enriched milk. Vitamin A and selenium are other micronutrients that could potentially be added in this way. The challenge will be to avoid making the eggs even more unaffordable to poor consumers by increasing the input cost (feed).

**Dick Tinsley [contribution 2, Ed.]**directly addresses this issue of affordability, directing us to a great tool which enables policy-makers to experience the dramatic trade-offs that the world’s poorest people have to make every day. It clearly shows why families in poor countries do not currently eat many eggs. The only way that this situation will change is if eggs become cheaper. And unfortunately, there are only two ways of making them cheaper: reducing the cost of feed, or increasing the scale of production. Both have challenges.

**Rabiu Auwalu Yakasai [contribution 3, Ed.]**shares an interesting experience from Nigeria, and suggests that “nutritional illiteracy” is the key constraint to consumption in this environment. This is in direct contradiction of the point made by Dick Tinsley. It would be great to see evidence that a programme which only educates families about the benefits of egg consumption can actually increase consumption. The special supplement finds that even including support to production, it is quite hard—but not impossible, as shown, for example, by Marquis et al.—to increase the consumption of smallholder families.

**John Cheburet** **[contribution 4, Ed.]** emphasizes the challenge of the cost of chicken feed. One has to wonder whether chickens in Africa have to consume maize and soy? It would be great to learn about alternative feed formulations which bring down the cost of egg production while meeting the nutritional needs of layer hens. It would also be good to know why Ugandan eggs are cheaper than Kenyan eggs? Do they produce at larger scale?

**Cedric Charpentier** **[contribution 5, Ed.]** raises a concern about conflict of interest. I would like to clarify that the International Egg Commission had no role at all in the production of the series, nor any of the individual papers. Cedric also correctly notes that there is very little in the series about animal welfare or potential environmental impacts; this is why we specifically asked for comments on these topics in this Forum. We would love to hear from Forum members whether there are examples of production of eggs at scale in resource-poor countries where animal welfare has been adequately considered? And what are good models for minimising environmental impact in these settings?

**Rabiu Auwalu Yakasai [contribution 6, Ed.]** raises an interesting point about egg powder. Would it be a good way to give poorer consumers access to the benefits of egg consumption, or is it just a capitulation to foreign trade interests? Clearly, this situation already applies for milk, where most of Africa currently consumers imported powder milk rather than fresh domestic milk. In this case, countries like Kenya are now turning this around by setting up milk ATMs supplied by local producers. Should countries just say no to imported egg powder?

**Kuruppacharil V. Peter [contribution 7, Ed.]** raises the case of India, where egg consumption is a politically charged issue. He points out that attitudes vary considerably from state to state. He notes frequently cited concerns about cholesterol. Readers may like to refer to the recent meta-analysis published in bmj (Ying Rong et al. 2013) which shows that “Higher consumption of eggs (up to one egg per day) is not associated with increased risk of coronary heart disease or stroke”.

## Mary Odusegun, NPOWER AGRO, Nigeria

In underdeveloped countries where poverty is the order of the day, people find it hard to purchase eggs. People feed and purchase food based on the quantity and not the quality. I think if youths who are interested in poultry business are supported with grants, subsidized and improved feeds then the cost of eggs will be reduced and accessible for the masses. Also there should be an interaction between the gown and town i.e. researches in the university should not just been dumped on supervisors shelf but extended to farmers. Thanks

##  Rabiu Auwalu Yakasai, Food and Nutrition Vocational Center, Nigeria

Facilitator,

It is clear evidence during the period of Ramadan fasting in Kano eggs become scarce commodity with inflated market price simply because of the flash rise of demand of the egg commodity at the onset of the fasting. In fasting period there is need of tasty, highly nutritious food ingredient that combines easily with several other ingredients to prepare variety breakfast (Iftar) meals. Egg is one of them.

In another example, one of the states in Nigeria was informed of the benefits of egg particularly to school children, the head of government decreed every school child in the state must be served school meal that contained an egg. That contributed to increased egg demand which drive proliferation of egg production farms to meet the demand. Nutritional literacy is a good precursor of increased egg consumption, at least in this part of the world.

Thank you.

## Cedric Charpentier, WFP, Italy

To Saul Morris - thank you for your response and for facilitating this discussions.

I did not talk about conflict of interest, just wondered what such a cooperation was supposed to give. My question stands.

There is a lot of work to do regarding animal welfare and consideration on the environment and those need to systematically be added to such discussions. Otherwise we are just ignoring some of the most important factors around animal husbandry recognized, by FAO, as one of the main polluter. So the question is: for the sake of some nutrition benefits, how much are we willing to jeopardize the environment and therefore the health of people, of other animals, of other nutritious plants... Is the trade-off worth it? According to FAO and others, not really. The food (and water) used to feed the chicken could be used differently.

We could also mention that the poultry industry is also a heavy user of medication for the animals which are then transmitted to our health. Not sure this is something that could be avoided in the developing countries. We do not have exemplary models at home of industrial poultry farming (which by definition is not good for the environment or health) ... so not sure one exists in other parts of the world.

## Bonphace Mangeni, Masinde Muliro University of Science and Technology, Kenya

Facilitator,

I started "One Village One Poultry Vet" Project - a socio-economic intensification programme to improve poultry production for dietary and economic benefits in western Kenya- Busia county in particular and it is successful.

Started with 20 small holder households in December 2016 and now targeting 200 farmers in two villages and there are positive results. Utilizing indigenous nutritional literacy content and building on it in a life long learning model has helped in the uptake of indigenous poultry as compared to the costly exotic poultry rearing.

Eating eggs by children is no longer a reserve for when they visit their grandmothers, or during ceremonies but has been picked up in family diets because of improved production in our intesification model.

Bonphace Mangeni-Western Kenya

## Hélène Delisle, University of Montreal, Canada

Eggs are among the taboo foods for children and pregnant women in several African cultures. The food taboos are more or less adhered to and one of the factors is education: the more educated people are more likely to free themselves from taboos. Therefore, the less educated people, who are also at higher nutritional risk, are probably those who would avoid eggs and consequently would need to be exposed to behavioral change communication to overcome the taboo.

Another type of egg taboo is that connected to the (now false) belief that because eggs are high in cholesterol, they increase the risk of CVD. There is now firm scientific evidence to show that eggs are not atherogenic.

Finally, the vegan trend would act as deterrent to consuming eggs (and other animal foods) and this could have adverse consequences for growing children. It has been shown some years ago that animal source foods are needed for optimal growth.

Hélène Delisle, Ph.D.

Professeur émérite et associé

Département de nutrition, Faculté de Médecine

Pavillon Liliane-Stewart, Université de Montréal

## Wilma Freire Zaldumbide, Universidad San Francisco de Quito, Ecuador

Original comment in Spanish

Estimados todos;

Me parece fascinante las contribuciones que se hacen en torno al incremento del consumo de huevos y su impacto en la nutrición de los niños, luego del paper publicado por Lanotti. Yo quisiera agregar el hecho de que nadie se pregunta qué piensa la población al respecto, por qué el consumo de huevo es bajo en las poblaciones en donde posiblemente se debe consumir más.

Por qué no preguntamos primero a las poblaciones, en el entorno de sus patrones de consumo, en su forma de preparar los alimentos, en las dietas que consumen, cómo ven el incremento del consumo de huevo. Por qué no incorporamos a los pequeños productores de las mismas poblaciones, e incluso a las mismas familias que tienen pollos y gallinas a su alrededor como mejorar su producción de huevos para el consumo y la venta y, de esta manera, no llegamos con los huevos, enriquecidos, con huevos en polvo o coloreados, como la solución mágica al problema de la desnutrición.

En la medida que no incorporemos a la población, en la solución de sus problemas, siempre habrá una brecha que no se la ha podido cruzar.

Promoción del consumo de huevo puede ser un vehículo por el cual se genere la participación de la población en el mercado al mismo tiempo que mejoren sus dietas de los niños y de la familia en general. Pero para ello necesitamos incorporar otras disciplinas, relacionadas a la organización social, al empoderamiento a la auto-sostenibilidad, para que sean ellos mismos los que adopten sus soluciones. Los años de experiencia nos muestran que las soluciones upper-down generalmente no logran los objetivos deseados, porque las poblaciones que son sujeto de intervenciones, no han tenido la oportunidad de hablar sobre su visión, su comida, sus patrones sociales y culturales en donde el huevo puede insertarse en forma permanente.

English translation

Dear All;

I find the contributions -following Lanotti´s paper- on increased egg consumption and its impact on child nutrition fascinating. However, I want to add that no one wonders what people think about this topic, and why egg consumption is lower than anticipated among populations that could benefit more from it.

I suggest asking people in first instance. About their consumption patterns, the ways they use for cooking food, their diets and their views on increased egg consumption. I also propose mainstreaming smallholders and even family poultry producers with the aim of improving egg production for sale and consumption. In this way we will not come up with fortified, powdered or colored eggs as the magic solution to undernutrition.

If we do not involve people in the solution of their own problems, there will always be a gap to bridge.

Promoting egg consumption can foster people´s participation in the market whilst improving children and family diets. To do this, other fields -related to social organization, empowerment or self-sustainability- need to be incorporated to allow people to adopt their own solutions. Experience shows that vertical solutions usually struggle to meet the desired targets as people are not given the opportunity to talk about their vision, food and social and cultural patterns where eggs can be embedded permanently.

## Christian Ciza, Democratic Republic of the Congo

Original comment in French

Bonjour! Pour moi je pense que pour lutter contre la malnutrition dans le pays en développement il fraudais recourir à l'intensification intégré de la production des œuf. C'est-à-dire intensifier la production tout en s'adaptant aux réalités locales du lieu de production.

Chercher le moyen de produir les œufs en quantité et qualité économiquement rentable tout en respectant l'environnement.

English translation

Hello!

I think that in order to fight malnutrition in developing countries it would be necessary to resort to the integrated intensification of egg production. That is to say to intensify the production while adapting to the local realities of the place of production.

We need to seek how to produce eggs in quantities and qualities that are economically profitable while at the same time respecting the environment.

##  Teopista Mutesi, FAO, Rwanda

Dear FSN moderator,

Thank you for this forum which I believe is very relevant as regards to ending malnutrition.

As a communications officer who have been to the field where FAO has implemented the poultry project in Rwanda, I have heard amazing testimonies of families with malnourished children who have been fed on eggs and the results have been impressive.

Kindly find links to some of the stories I have covered touching also on the benefits of eating eggs for children with malnutrition.

STORY 1: Victor Gashema has been providing eggs to the health center in his area and has seen many malnourished children coming out the red line. The subtitle on eggs is towards the end of this article: <https://bit.ly/2CSefD2>

STORY 2: Annociata Benimana had a malnourished child but after joining FAO's poultry project she fed the child on eggs and the status improved.

“I had gone for a mandatory child nutrition test at the health center, when I was told that my child exhibited signs of stunting,” says Benimana Annociata, a mother of five children. The story is on page 5: [bit.ly/2HPdrya](https://bit.ly/2HPdrya)

Thank you,

Teopista

##  Vethaiya Balasubramanian, Freelance Consultant, India

In Tamil Nadu, India, mid-day meal is provided to kids, especially those from poor families, in government schools. In this scheme, one egg is provided to each child every day on school days (Monday to Friday only). It has been found the health of the children taking eggs in mid-day meals has proved significantly. Eggs can rove nutrition of poor kids and their parents, if they can afford them. To keep the access of eggs to the poor, the price of eggs must be as low as possible.

To keep the price of eggs low, the feed cost must be either kept low by innovative methods (e.g., converting food wastes into poultry feed) or egg price must be subsidized by local governments to improve the nutrition of the poor. After all, the food and nutrition security of people, especially the poor, is a key responsibility of the local and or national governments.

##  Wajid Pirzada, Roots Pakistan, Pakistan

Eggs indeed are relatively cheaper and ready-to-use high quality food for all ages. Consumption of eggs in rural population however, has decreased over last 3-4 decades, implying that 3/4th of world population has now limited access to this high quality food 'Capsule'. This decrease in consumption of egg can be attributed to:

i. Significant drop in backyard poultry farming- many of the rural poultry breeds have become extinct over time.

ii. Displacement of rural poultry by commercial farming.

iii. Lack of aesthetic taste in commercial eggs viz a viz backyard poultry eggs

iv. Cost of commercial eggs, as compared to 'home-grown' eggs- backyard farming produce

On the other hand, consumption of eggs has increased in urban settings, because of inter alia:

i. Readily available commercial eggs at relatively cheaper price, compared to backyard farming produce, which fetch higher price because of its aesthetic values (both taste and color).

ii. Use of eggs in multiple dishes and baking products.

Given that 3/4th of world population resides in rural areas, and that egg consumption has dropped in these areas, it could be one of the contributory factors towards growing malnutrition and consequent upon increased stunting among developing regions of the world.

'An egg a day' campaign in Schools and egg-based daily food supplementation for pregnant and lactating mothers can help improve the nutritional health especially of women and children.

Promotion of Good Poultry Husbandry Practices and value chain & SPS management can help contain the health risks associated with egg consumption.

Value chain development in egg sector can help reduce the cost of egg products, and increase in its consumption.

Manipulation of poultry feeding- through informed nutrition can help in mitigation of GHGs emission from factory poultry farming.

##  Akhila Vasan, GMA Science and Education Foundation, United States of America

Eggs (similar to milk) are nutritionally dense and can be affordable, thus supporting the goal of reducing food security.

1. Food Safety is a fundamental basis for ensuring access to safe eggs, so having proper procedures in place to prevent avian diseases as well as bacterial contamination should be addressed.

From the perspective of increasing access:

1. Both small holder farms/household farms as well as large scale in country producers can support access to eggs. With small scale and household farms, this can be a means of women's empowerment, and thus lead to a continuous resource. For large scale production, the government working together with private sector can produce subsidized eggs for those in need. Furthermore, children can gain access to eggs as a nutritionally dense food at mid-day meals or similar programs. This could also be an added benefit where children are more likely to attend school due to access to food (most likely their only meal for the day). In terms of trade, the political environment in the region will also need to be considered before developing the egg supply chain. An example of how the balance between large and small scale production can work, can be borrowed from the dairy industry. Small holders continue to produce milk but supply the milk to bulk tanks, and a similar model can also be used for eggs to support both small holder and larger scale operations. That would also ensure sustainability of the larger operations thus ensuring continued interest. If the model is not self-sustaining, it will fail.

2. To increase demand for eggs, incorporating cultural and flavor preferences and using the community (elders/leaders/religious heads) to support the initiative will help. Let's face it, eggs while nutritionally dense, can also be a blank slate for flavors.

3. Having different players at the table (PPP), and involving government, academia/NGOs/religious institutions, and industry (egg producers, chicken feed, etc.) to build the solution together will help ensure buy in. Initial seed funding, along with support from different stakeholders helps to ensure that the solution works for everyone AND is addressing the problem.

##  Tim Lambert, International Egg Commission, Canada

Thank you for the opportunity to co-facilitate this discussion and for your thoughtful contributions to date. Your comments have been great to read through.

Many of you have raised the issue of education, not only on the benefits of eggs, but also in the area of food skills. Although, as Dr. Hélène Delisle points out, scientific evidence has now proven that eggs do not increase the risk for CVD, there remains an important opportunity to educate governments, health professionals and consumers in this area, and to highlight the many nutritional benefits and high quality protein of eggs.

The examples given by Rabiu Auwalu Yakasai of the FEED program and the stories shared by Teopista Mutesi of the FAO poultry project illustrate the powerful impact that skills development and knowledge transfer can have on improving nutritional status. Please continue to share your success stories and lessons learned towards similar projects.

The International Egg Foundation, in partnership with local communities, seeks to increase both egg production and consumption. One example is the work with Heart for Africa, where a newly-constructed egg farm in Swaziland is adding a sustainable source of protein to more than 888,000 meals per year. In Uganda, a local contact works with children to develop the skills to care for hens and later build the skills to manage a small business. The project provides families with a sustainable source of protein and the opportunity to expand their efforts.

Much like these projects there is an opportunity to share knowledge and evident-based research to strengthen farming practices. For example, in Canada, Codes of Practice and nationally developed guidelines serve the foundation for ensuring hens are cared for using practices that promote animal health and welfare. There are also a number of well documented research studies that discuss a host of welfare factors in egg production. Forum participants may like to refer to the Wageningen University and Research Institute’s LayWel study, or the Coalition for Sustainable Egg Supply study that analyzed animal health and well-being, food safety and quality, environment, worker health and safety, and food affordability.

On the topic of sustainable egg production, researchers in both Europe and North America are helping producers make sustainability improvements. These studies offer important information that reduce the environmental footprint of egg production, while producing more eggs with fewer resources. These tools deliver practical and impactful opportunities to tackle environmental challenges. While these results are positive, there remains an important opportunity to share these insights more widely. I am very interested in your thoughts on new areas to explore when it comes to sustainable egg production.

I look forward to reading through more contributions highlighting ongoing projects, successes and challenges with making eggs more accessible. Thank you again for your thoughts.

## Peterson Kato Kikomeko, Kyambogo University, Uganda

Response on the different ways that we could increase demand for eggs, other than increasing availability and reducing price? What are some examples of successful initiatives?

1. Increase public awareness of the nutrition benefits of eggs. If more people know the nutrition benefits of eggs, the likelihood of consuming eggs are higher.

2. Promote consumption of egg-based dishes/meals; in Uganda, the government is promoting consumption of the "Rolex" which is basically an egg omelet wrapped in a chapati as part of the food tourism. This is indirectly increasing egg consumption.

## Max Blanck, FAO, Italy

Dear All,

Thank you very much for all these interesting comments.

I would like to share with you an infographic produced by FAO in 2015 providing an overview on some facts around the egg, its nutrition properties, production figures and consumption trends <http://www.fao.org/resources/infographics/infographics-details/en/c/284410>.

All the best

Max

## Kazungu Rauben, Makerere university, Uganda

Dear all,

Responding to topic "Response on the different ways that we could increase demand for eggs, other than increasing availability and reducing price? What are some examples of successful initiatives?"

The consumption of eggs in Uganda has increased of recent because of formalizing of "Rolex" in tourism industry as Peterson Kato Kikomeko noted. However, egg consumption is likely to drop because of the 'Fake eggs' that were found being sold on Ugandan markets. A case to mentions is Chinese company that was found selling fake eggs made from yet to be established chemicals by Uganda Government Analytitical Lababalary. Unless quality standards of eggs in the markets are streamlined, fake eggs will explode the market since they are artificially made and sold at cheaper prices compared to normal eggs and can sustainably meet the increasing demand of eggs by the local population.

## Lawrence Matolo, Machakos University, Kenya

Hello Moderator.

Thank you for recognizing the need to discuss the egg as a powerful tool for mitigating poverty and malnutrition among the poor communities of the world.

I grew up in rural eastern Kenya where the egg was generally accepted as a currency.

Our parents would send us to the market to 'buy' basic household utilities; mostly salt, sugar, soap, kerosene, cooking oil and onions using eggs as currency.

At school we later came to learn about barter trade, though it wasn't the case here. Essentially eggs were treated as currency because the shopkeepers never used to cook and eat the eggs that they collected from us as it would have been the case in a true barter trade situation.

It's possible to bring the egg back to its rightful economic position in rural livelihoods not as a currency anymore but as a means of addressing malnutrition, unemployment and generating income for rural and urban even development.

This is achievable through the use of research based egg production systems with a corresponding creation of demand for the eggs through innovative and affordable food formulations. For example, the infusion of eggs into traditional dishes would go a long way in achieving this.

The challenge of generating greenhouse gases would be addressed through the small-scale egg production approach which would disperse the impact of the gases over a wide geographical area.

Above all this, there's urgent need to educate and sensitize the involved communities about the importance of the egg and its 'newly acquired socio-economic status' so that they don't end up selling eggs to buy low nutritional value food commodities as we did in the 1960s and 70s.

We should work together towards making the egg to occupy its rightful place among communities as a generator of currency and good health but never again as a currency itself.

Lawrence Matolo,

Machakos County,

Eastern Kenya.

## Olutosin Otekunrin, Federal University of Agriculture, Abeokuta, Nigeria, Nigeria

Dear All,

Dwelling on the prevailing discussion "increase access to eggs for the world’s poorer populations, what should be the right balance between small-scale productions, large-scale commercial production. What is the way forward to achieve increase in egg production for better nutrition in Sub-Saharan Africa (SSA).

Constraints to increased Egg production for Better Nutrition in Sub-Saharan Africa (SSA)

Eggs are a highly nutritious food, rich in Eessential Fatty Acids, vitamins A and B12, and bioavailable iron, zinc, and iodine. The protein in the albumen is abundant, digestible, and complete, and the whole food is naturally “packaged” in a protective “container.” With a few notable exceptions, it is an acceptable that almost all human populations enjoy eating them. They are uniquely positioned to advance the second of the world's Sustainable Development Goals (SDGs)—to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture (United Nations, 2015).

Consumption of eggs, however, falls far below optimal levels among mothers and children living in poorer countries especially in the Sub-Saharan Africa (SSA). The level of production in this region is not adequate to provide needed nutrition for everybody especially the children and the mothers. Eggs are cheap, relatively available, and frequently consumed by young children in high-and middle-income countries. However, they are expensive, scarce, and rarely consumed by children in much of Africa and South Asia.

Major barrier to increased egg production for better nutrition in SSA include the following

 (i) Low production

 (ii) Disease

 (iii) Nutrition, Housing and Incidence of Predation

(iv) Veterinary and intensive systems

Low Production: When considered the conventional measures of productivity commonly used in the commercial poultry sector in both aspect of egg and meat production, such as feed conversion ratios or daily weight gain, local chicken breeds are low and slow producers of eggs and meat. This contributes to their low productivity when compared with the production in the commercialized poultry production setting.

Disease: The most common cause of the high mortality rates observed in Small -Scale Poultry (SSP) flocks, particularly in tropical countries, is Newcastle disease (ND) and Avian Influenza (AI). The emergence of and response to Highly Pathogenic Avian Influenza (HPAI), the H5N1 strain of avian influenza caused millions of birds to be culled after emerging in Africa in 2006-2008, and many countries in Africa have lost a large proportion of their egg production industry. This placed a heavy burden on SSP producers, directly, by the virtue of increased loss of birds, and indirectly, as initial control measures resulted in massive depopulation, often with inadequate or no compensation especially in the developing nations.

Nutrition, Housing and Incidence of Predation: Inability to provide adequate nutrition and presence of environmental stress coupled with the incidence of loss of chicks to predation are other notable factors that can contribute to reduction in the production of poultry products (especially eggs) in the SSA

Veterinary and Extension Services: Smallholder poultry farmers do not or have limited access to information on the “state of health” of their birds and how to cope with clinical signs and symptoms of diseases on their farm. This includes issues of adequate biosecurity practices, which is a major concern for small-scale intensive poultry producers. Inadequate essential resources and infrastructural facilities can result in limited veterinary and extension services.

Possible way forward

Establishment of “Egg Hubs” (Beesabathuni et al., 2018; Ymeri et al., 2017)

This is an innovation in which smallholder poultry (egg) farmers are organized into groups to facilitate input supply and better reap economies of scale. In this model, groups of five smallholder farmers constitute one group and are trained to operate a small‐scale farm with 5,000 birds, thereby simplifying supply chain coordination of inputs to the farm while also ensuring minimal losses in the transport of eggs to a market closest to the community.

Each farmer group has access to credit, building materials, cages, start‐up flock and relevant materials, biosecurity measures, protective clothing, and training in best practices. Several of these farms can be managed together as a hub. The hub acts as the aggregator of inputs and provides training, insurance, and credit to the farmer groups. For countries with large rural land areas, which, as we have seen, would require more than 200 hubs to ensure an egg for everyone, creating incentives for private companies to set up the hubs is the likely accelerated pathway to scale.

Eggs are one of our best tools to help end hunger, achieve food security, and improve nutrition. In order to reap the benefits of this opportunity, it is crucial that aggressive action be taken to increase and improve their availability and affordability in SSA. This can only be done by investing heavily in production systems that can bring down prices significantly across the entire economy, rather than focusing effort on limited benefits for individual farmers.

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## Santosh Kumar Mishra, Population Education Resource Centre (PERC), Department of Continuing and Adult Education and Extension Work, S.N.D.T. Women's University, Mumbai, India

**1) In order to increase access to eggs for the world’s poorer populations, what should be the right balance between small-scale production, large-scale commercial production, and long-distance trade? If countries do increasingly move towards large-scale production, how do we balance the interests of better nutrition with concerns about smallholder livelihoods?**

**1.1) In order to increase access to eggs for the world’s poorer populations, what should be the right balance between small-scale production, large-scale commercial production, and long-distance trade?**

The answer to right balance between “small-scale production”, “large-scale commercial production”, and “long-distance trade” lies in locally prevailing situations.

**1.2) If countries do increasingly move towards large-scale production, how do we balance the interests of better nutrition with concerns about smallholder livelihoods?**

National governments need to look into nutrition aspects of egg production through appropriate strategies that focus on farming and hygiene issues. As regards balancing act between nutritional aspect and safeguarding the interests of small scale egg producers, there is need to involve all stakeholders in planning and implementation process. Most importantly, the viable and practical solutions should come from joint consultation, especially by involving community level stakeholders, including egg producers. There is no standard formula to ensure balance.

**2) What are the different ways that we could increase demand for eggs, other than increasing availability and reducing price? What are some examples of successful initiatives?**

A) Strategies Required for Increasing Egg Demand:

Eggs are wholesome, nutritious food with high nutrient density. They provide 12% of the daily value for protein and a wide variety of other nutrients like vitamins and minerals, along with various other important ingredients so crucial for growth and good health.

Protein in the nutrition is one of the most important health indices that affect children's growth and development. Lutein and zeaxanthin are two newly-recognized nutrients that have put eggs in the "functional foods" category. A functional food is one that provides health benefits beyond its basic nutrient content. Recent studies have shown that consuming lutein and zeaxanthin can significantly lower risk of age-related macular degeneration (AMD), a leading cause of blindness affecting people over the age of 65. In addition, there is a less likelihood of cataracts (source: accessed on November 05, 2018 from: [http://dahd.nic.in/sites/default/filess/Seeking%20Comments%20on%20National%20Action%20Plan-%20Poultry-%202022%20by%2012-12-2017.pdf)](http://dahd.nic.in/sites/default/filess/Seeking%20Comments%20on%20National%20Action%20Plan-%20Poultry-%202022%20by%2012-12-2017.pdf%29)).

As regards strategies for increasing demand for eggs, information, education and communication (IEC) need to be touched upon. In more accurate terms, this will require “educational intervention”, wherein the national governments, across the regions of the globe, all those involved (including health educators and medical/para-medical personnel) should educate masses about significance of egg consumption. This initiative can envisage engaging print, electronic as well as digital (including social) media. Universities, colleges and other educational institutions can make difference.

B) Examples of Successful Initiatives:

a) American Egg Board – Introduction to the Initiative:

Today, just two percent of the U.S. population lives on farms, producing food for the remaining 98 percent of the population. America’s egg farmers continue to modernize egg farming production and processing practices in order to meet the demand for nutritious, high-quality eggs.

America’s egg farmers have very strict safeguards and practices they follow to make sure their hens are healthy and to protect the quality of the eggs. Hen health and egg quality are the top two priorities on egg farms all day, every day. Egg farmers follow guidelines to ensure the hens are provided with nutritious feed, clean water, proper lighting and fresh air. Light, housing, diet and health are very important to the production process in order to provide high-quality eggs, and therefore, very important to the egg farmer. Advances in science and technology help egg farmers preserve safety and quality throughout the gathering, inspecting, packaging and handling process (Source: Accessed on November 5, 2018 from: <https://www.aeb.org/farmers-and-marketers/ftip>).

b) Production Process:

The egg production process includes the following phases:

Laying: Hens lay eggs in a controlled environment and are fed a high-quality, nutritionally balanced diet of feed made up mostly of corn, soybean meal, vitamins and minerals to produce quality eggs.

* Collecting: Some eggs are still gathered by hand, but in most production facilities, automated gathering belts do the job.
* Washing: Although the hen supplies the bloom, a natural coating to protect the porous shell, in nature, the coating dries and is lost. The bloom is also lost through the egg washing process when the eggs are washed and sanitized.
* Candling: The step in the grading during which the farmer (egg grader) looks inside the egg, without breaking it, to determine the quality.
* Grading: Farmers classify their eggs by the interior and exterior quality at the time it is packed. Grades include AA, A or B. There is no difference in the nutritional value between different grades and all eggs sold at the retail level must meet the standards for Grade B or better. However, few Grade B eggs find their way to the retail market:

Grade AA: Egg content covers a small area – white is firm and has thick white surrounding the yolk, and a small amount of thin white. The yolk is round and elevated.

Grade A: Egg content covers a moderate area. White is reasonably firm and has a considerable amount of thick white and a medium amount of thin white. The yolk is round and elevated.

Grade B: Egg content covers a very wide area. White is weak and watery, has no thick white and the large amount of thin white is thinly spread. The yolk is wider than normal and flat.

* Sorting & Packing: Eggs are sorted according to size (minimum weight per dozen) and should be placed large-end up in their cartons.
* Shipping: Egg farmers ship their eggs in refrigerated trucks. Most eggs in the U.S. reach the grocery store just one day after being laid and nearly all of them reach the store within 72 hours, or 3 days.
* Selling & Storing: Eggs must be refrigerated. An egg can age more in one day at room temperature than in one week in the refrigerator. The best place for the egg is in its carton on an inside refrigerator shelf.
* Enjoying: America’s egg farmers produce a high-quality product that provides all-natural, high-quality protein, that is now 14 percent lower in cholesterol (down from 215 mg to 185 mg), and 64 percent higher in vitamin D.

(Source: Accessed on November 5, 2018 from: <https://www.aeb.org/farmers-and-marketers/ftip>).

**3) How can we mitigate the potential downsides of large-scale egg production on animal welfare and carbon emissions?**

3.1) Large-Scale Egg Production and Animal Welfare:

Technology can play significant role in ensuring animal welfare while ensuring large-scale egg production. However, assessing welfare in large poultry flocks, to be able to detect potential welfare risks and to control or minimize its impact is difficult. Current developments in technology and mathematical modelling open new possibilities for real-time automatic monitoring of animal welfare and health. New technological innovations potentially adaptable to commercial poultry are appearing, although their practical implementation is still being defined. In this paper, we review the latest technological developments with potential to be applied to poultry welfare, especially for broiler chickens and laying hens. Some of the examples that are presented and discussed include the following: sensors for farm environmental monitoring, movement, or physiological parameters; imaging technologies such as optical flow to detect gait problems and feather pecking; infrared technologies to evaluate birds’ thermoregulatory features and metabolism changes that may be indicative of welfare, health and management problems. All these technologies have the potential to be implemented at the commercial level to improve birds’ welfare and to optimize flock management, therefore, improving the efficiency of the system in terms of use of resources and, thus, long term sustainability (Accessed on November 5, 2018 from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5082308/>).

3.2) Large-Scale Egg Production and Carbon Emissions:

Information on the sources and magnitudes of greenhouse-gas (GHG) emissions from livestock food production is of considerable interest to policymakers. Recently, several governments have committed to: (a) reduce greenhouse gas emissions; and (b) minimize the projected impacts of climate change. The GHG from red meat production are relatively well understood and high in comparison with poultry meat production. The difference is largely due to the contributions of methane and nitrous oxide. The Intergovernmental Panel on Climate Change (IPCC) has made significant contribution in studying and understanding underlying linkages between large-scale egg production and carbon emissions (Accessed on November 5, 2018 from: <https://academic.oup.com/ps/article/93/1/231/1540406>). Eggs constitute a major alternative source of animal protein in the UK, but information on the GHG emissions associated with UK egg production is limited to studies of partially comparable US intensive systems and UK studies modeling aggregated national data. A recent review of the sustainability of egg production highlighted these gaps in understanding of their environmental impact (Accessed on November 5, 2018 from: <https://academic.oup.com/ps/article/93/1/231/1540406>).

**4) What do we need different stakeholders (governments; private sector; academia; normative agencies) to do to accelerate access to eggs in poor communities?**

Setting directions and goals for animal production systems requires the integration of information achieved through internal and external processes. The importance of stakeholder input in setting goals for sustainable egg production systems for poor communities should not be overlooked by the agricultural animal industries. Stakeholders play an integral role in setting the course for many aspects of egg, from influencing consumer preferences to setting public policy. The Socially Sustainable Egg Production Project (SSEP) involved the development of white papers on various aspects of egg production, followed by a stakeholder workshop to help frame the issues for the future of sustainable egg production. Representatives from the environmental, food safety, food retail, consumer, animal welfare, and the general farm and egg production sectors can facilitate making egg accessible for poorer section of the population across the regions of the globe (Accessed on November 5, 2018 from: <https://academic.oup.com/ps/article/90/9/2110/1497397>).

See attachment: Contribution to FSN Forum Online Discussion on Eggs, harnessing their power for the fight against hunger and malnutrition.Dr\_. Santosh Kumsr Mishrsa.Mumbai.India\_.November 5, 2018.docx

## Rose Hogan, Trocaire, Ireland

Chickens are one of the main and most common assets of poorer rural households and they are transportable and easily converted to cash in times of extreme risks and temporary migration. Local breeds are the toughest survivors and generally don't need specially grown or purchased feeds.

One of main challenges to poor rural households who wish to keep chickens is disease, especially Newcastle disease. The vaccination against it is cheap and easily administered. However the most efficient and effective vaccination approach is a collective one whereby whole communities of people collaborate to vaccinate on a regular (usually quarterly) basis.

Unfortunately few NGOs, who wish to promote poultry keeping, support this approach but rather distribute chickens (often fragile exotic breeds) to individual households without studying the disease history.

To impact on rural household nutrition as the primary focus, chicken disease prevention on a geographical and or administrative areas basis can be a very cheap way to facilitate the survival and multiplication of the poultry stock poor rural people already have.

## Brandon Eisler, Nutritional Diversity, Panama

A Contribution to the United Nations Forum on Global Food Security & Nutrition

Harnessing the Power of the Humble Chicken Egg in the Fight Against Hunger & Malnutrition

November 3, 2018

The "Humble Egg," as Saul Morris and Tim Lamber (the FAO.org Egg Forum administrators) put it; I have found through our intensive [Nutritional Diversity study here in Panama](https://nutritionaldiversity.com/), to very certainly be everything that is hoped for by this discussion's introductory comments.

Through experimentation with [Nutritional Diversity Diet for different livestock](https://nutritionaldiversity.com/), we came up with a few incredibly effective [chicken food creation systems](https://nutritionaldiversity.com/chicken/), that was based on a "grow soil not plants-type" of idea and a "use what you got-type" of attitude that saw drastic increases in egg production and overall chicken health.

In the case of the ND chicken study it was about moving chickens to new ground, where they can find a diversity of new insects naturally and developing insect production systems to provide a constant nutritionally diverse worm staple. Putting large rows of bucketed out food scraps approve 70 feet from the house, helped detract pests that were otherwise attracted to the smaller food piles left out for shorter times, like during cooking. We would allow insects to visit the food scraps and eventually buckets of grubs is what we had. The simple natural decision to learn to attract and use the most popular larvae worm or grub type naturally occurring was a winner. I am really proud that we took the time and really communicated strong love and care to our chickens during the life of that particular study and line of experiments.

During this time on the Caribbean Island of Colon, of Bocas del Toro, the farm inherited an abandoned young person who we all learned an immense and dynamic set of lessons from. His diet became Nutritionally Diversity and eggs. For our many chapters of economic stress, eggs became the principle protein group in the diet for the entire farm family there.

Many modern diet subscribers would say that eating too many eggs runs a cholesterol and acidity risk. We have found the egg heavy diet to be incredibly sustainable both in times of poverty and for our personal nutrition. Eggs are serious in nutrition and the cholesterol concerns are addressable by donating a certain amount of yoke to compost, to rabbits, to bee's or back to nature in other ways.

The amount of time that chickens have been used in sustainable agriculture dates back at least 10,000 years. We had good energy and sustained muscle mass using eggs this way, we did not encounter any sort of problem, again this is combined with 50-100 other species, and in this type of consumption model, not much is a problem.

I maintain and drive the point always that a diverse spectrum of plants at 5x (gram weight) that of protein consumed makes the optimal diet for humans and this concept I write under the title Nutritional Diversity, and low and behold, I also found this to be true of chickens. These guys are very happy to eat a Nutritional Diversity diet of their own. Their selection of plants as they are moved around the farm or wild terrains using an electric portable fence can be quite the revealing experiment in a good number of ways.

Chickens when let out can follow the farmer who loves them in a quiet loyal and local fashion. When that bucket of worms goes back in the pen, you can expect they will be right behind it. They are very interpretable, and there are many different species of chicken. These guys deserve a story and no living thing deserves to be caged or kept on its own feces for long. Just like all nature they depend on and deserve a diverse environment rich with thousands of other living souls.

The balance of give and take must be appropriate, at a minimum with our animals and with our plants. The strongest system is the one that gives the most love and care, and the most diversity.

We must stop trying to control so much as much as we need to let nature do its own job. The most divine of us will realize beyond that, to really take care of and propagate our environment and diversity into abundance for all. There is a social cultural aspect to our methods that is grossly overlooked and therefore even more important than ever today. We all know the free range chicken is a more healthy and nutritious product than the factory abuse of the living animal does. Chickens also can remove the need for harsh pesticides that plague or precious pollinators and seriously threaten our remaining ecology.

Small groups of seven to thirteen chickens in moveable chicken fencing and moveable houses is what I found to work very well. Chicken tee-pee style houses rolled up with Premeir (or other) temporary solar powered roll fencing into backpack or horse / iron horse carry bundles which makes it more manageable, easy and could bring in a whole new set of possibilities for a free roam large range secure chicken farming plan. In the interest of global freedom and food security the chicken egg, is a great egg but it is not the only egg, or the only food fowl. A repopulation of all diverse species to abundance effort is a repetitive final thought in the freedom and security conversation. See also Guerilla Permaculture, A More Integrated with Nature Free Permaculture System.

Working chickens and other natural fowl into multistage mutlifacted sustainable agriculture models rooted in the fact that they are free and loving, should be ahead of other science, and the fact that it is not at the level yet of replacing pesticide use, is shameful. It can be as easy as selecting public land, deciding to love it, and starting to see what invited species take a liking to it also.

See attachments: [United\_Nations\_Forum\_on\_Sustaineable-Agriculture\_Egg-Farming.pdf](http://www.fao.org/fsnforum/sites/default/files/discussions/contributions/United_Nations_Forum_on_Sustaineable-Agriculture_Egg-Farming.pdf)

Humbly,

Brandon Eisler

[Nutritional Diversity](https://nutritionaldiversity.com/),

[A Complete All Natural Guide to Human Optimization](https://nutritionaldiversity.com/).

## Dick Tinsley, Colorado State University, United States of America

As I have been following the conversation I think we have done a great job of academic side of the egg and defining how nutritious it is and important to get into the diet, I hope we can start focusing on the development side and how to afford the egg so it can get into the diet. Thus I would like to return to the exercise is introduced into my initial comment about "hart choices: compromises in quality Nutrition". Has anyone downloaded and attempted to the exercise and for the poor of the world relying on heavy manual labor as their only economic opportunity tried to see what the compromises are in including or excluding the egg for the diet or the children’s diet. The exercise link is: <http://smallholderagriculture.agsci.colostate.edu/1028-2/>

## Jesper Møller Nielsen, R2 Agro, Denmark

An interesting and simple way to address a complex problem.

I represent a company R2 Agro where we take nutrition very serious. We have developed a feed additive for animals which provides improved storage time. Eggs have better haugh unit and for chicken breast meat longer storage time. (University proved studies)

This addresses another relevant issue in not having food to cause diseases.

Jesper Møller Nielsen

## Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom

Once again it has been a pleasure reading the contributions of Forum members over the last week.

Several contributors have echoed themes expressed in the special supplement of Maternal and Child Nutrition. **Teopista Mutesi** notes that eggs can support improved nutritional outcomes in children. **Mary Odusegun** notes that eggs can be unaffordable for the poor, and **Lawrence Matolo** notes that in his home area when he was a child, eggs were so expensive that they were essentially used as currency. **Christian Ciza** notes the need to intensify production, and **Akhila Vasan** suggests an aggregation model perhaps similar to the egg hub discussed in the series. **Hélène Delisle** remarks on the need to combat taboos and unfounded health concerns, and **Wajid Pirzada** and **Peterson Kato Kikomeko** advocate for promotion campaigns along the lines of “an egg a day”. **Olutosin Otekunrin** helpfully summarises several of the messages of the series.

Other contributors have broadened the discussion and pointed us to new evidence in this area.

**Santosh Kumar Mishra** directs us to some additional sources which beautifully complement the recent series in Maternal and Child Nutrition and shed light on topics which were barely covered there. One paper (Ben Sassi, Averós & Estevez, 2016) reviews recent technological developments which could be applied to animal welfare. Another (Taylor, Omed & Edwards-Jones, 2014) helps us understand the carbon footprint of egg production. This paper concludes that “Eggs represent a relatively low-carbon supply of animal protein, but their production is heavily dependent on cereals and soy, with associated high emissions from industrial nitrogen production, land-use change, and transport. Alternative sources of digestible protein for poultry diets are available, may be produced from waste processing, and would be an effective tool for reducing the industry's GHG emissions and dependence on imported raw materials.”

**Rabiu Auwalu Yakasai** reminds us that school feeding can be an effective way to guarantee demand for eggs at scale, thereby incentivising new investment by businesses. **Vethaiya Balasubramaniam** also discusses school feeding, in this case pointing to the successful experience of the state of Tamil Nadu in India. Although less impactful than school feeding as a way to target nutrition to the most vulnerable, governments can also encourage other institutional purchasers—national airlines, for example, or the army—to buy locally and ensure offtake from growing producers. These measures might make prices rise in the short term (as has reportedly happened in several Nigerian states), in the medium term prices should fall as businesses are able to reap economies of scale.

**Wilma Freire Zaldumbide** emphasises how important it is to involve affected populations themselves in the design of interventions to improve nutrition. This in fact reinforces the findings of Carlos Andrés Gallegos Riofrío, published in the recent supplement of Maternal and Child Nutrition, who designed an intervention “informed by culturally based norms, values and local expectations” and fostered community empowerment.

We would still love to hear from more contributors who have effectively solved issues of animal welfare, demand creation, and price reduction in markets with high burdens of malnutrition.

## Tim Lambert, International Egg Commission, Canada

Thank you for your continued interest in this discussion and thorough comments.

Many of you have highlighted the need for better education and communication on the benefits of eggs. One example of a successful initiative out of Canada was a Physician Education Program, through which Egg Farmers of Canada spent 7 years meeting with individual Family Physicians across Canada to share recent science related to eggs, cholesterol and nutrition. Through this program, they were able to reduce the number of Canadian Family Physicians limiting their patients’ egg consumption from 65% to 25%. This played a huge role in improving the perceptions of eggs with the medical community, and in turn with their patients.

**Santosh Kumar Mishra** describes some of the standards in place on American farms to maintain the safety of eggs and the welfare of the hens. The Canadian industry has similar programs in place and will be launching a new program in 2019 which will tell consumers, through the use of an on-pack mark, that their eggs are produced according to highest food safety and animal care standards. The [Egg Quality Assurance (EQA)](https://eggquality.ca/) program goes hand-in-hand with Egg Farmers of Canada’s commitment to continuously improve and strengthen egg farming practices to safeguard Canada’s food supply. [The British Lion Egg](https://www.egginfo.co.uk/british-lion-eggs) program is another example of a long-standing and successful program that has increased the trust in the egg industry and greatly reduced the presence of Salmonella in the UK since its launch in 1998.

On the topic of sustainable nutrition, I’d like to share an article written by Dr.Mickey Rubin, Executive Director for the Egg Nutrition Center in the United States. The article, titled [“ Healthy, Sustainable Eating Patterns and the Importance of the Big Picture”](file:///C%3A%5CUsers%5Cchristinea%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5C04TPO93C%5CHealthy%2C%20Sustainable%20Eating%20Patterns%20and%20the%20Importance%20of%20the%20Big%20Picture) highlights some of the key findings from a [Lancet Planet Health](https://www.ncbi.nlm.nih.gov/pubmed/30082049) study looking at measures of sustainability in recommended dietary patterns, and really illustrates the much broader considerations in sustainable nutrition than just greenhouse gas emissions. To further emphasize the societal aspects of sustainability, Dr. Rubin also touches on the [Lulun project](https://academic.oup.com/nutritionreviews/article-abstract/72/6/355/1869975?redirectedFrom=fulltext) in Ecuador, which is also referred to in the special supplement of the [Journal of Maternal and Chid Nutrition](https://onlinelibrary.wiley.com/toc/17408709/2018/14/S3) we have framed this discussion forum around.

There is an important message in **Rose Hogan's** comments towards farmers working together and collaborating to find efficiencies and to address challenges. I have had the opportunity to see the positive impact of farm communities working together across the world, and whole-heartedly believe that this not only strengthens the voice of the farmer in the value chain, but also delivers tremendous value to the entire agricultural community.

**Olutosin Otekunrin** comments raise an important point in disease prevention and management. Avian Influenza is a significant threat to egg producers around the world. This risk underlines the importance of bio-security in preventing outbreaks and reducing subsequent transmissions. There is interesting work being conducted around the world on this specific topic. Some members of the Forum may be interested in the reading up on the [Avian Influenza Global Expert Group](https://www.internationalegg.com/representing-the-industry/egg-industry/avian-influenza-global-expert-group/). The group contains senior representatives from the World Organisation for Animal Health, world-class scientists and industry representatives. Their focus is to come up with practical ways of better managing this threat.

Thanks again for your thoughtful comments and insight. As Saul has already touched on, we look forward to your thoughts on strengthening animal welfare, increasing demand and consumption of eggs, and identifying production efficiencies.

## Peter Kingori, Turnsbridge Analytica, Kenya

Interesting debate.

1. Eggs have great potential as demonstrated in current research, to contain the pervading threat of malnutrition in developing countries.
2. Promoting egg production among poor households may face the challenge common in such situations i.e. poor families will prioritise cash benefits of selling eggs as opposed to the nutritional benefits
3. advocacy and sensitization of families critical for such a project to work.
4. Suggest piloting, drawing lessons before scale up.

## Mahesh Chander, Indian Veterinary Research Institute, India

Per person per year egg consumption in India is just only 66 eggs, with huge regional variations. For instance, in Uttar Pradesh it is only 10 eggs. While in neighboring China, it is 300 eggs/head/year. Appreciably, the National Institute of Nutrition- an institution under Indian Council of Medical Research has recommended and made the provision of eggs compulsory in mid-day meals, being cheaper, safer, more nutritious and easier to procure than alternatives such as milk or bananas. In spite of recommendation coming from such a high level institution, it has not yet been implemented in many states. In the matters of health, people, institutions and government must rise above social and religious considerations, if any. The National Egg Coordination Committee (NECC) has made efforts in India to boost egg consumption among public in general and school children in particular. Such efforts need support from public and institutions. The celebrating World Egg Day on the second Friday in October each year is one good way of boosting egg consumption. The institutions concerned with livestock and poultry research and production should shoulder the responsibility of promoting egg consumption. The private sector especially the poultry industry can play larger role by launching egg promotional campaigns, possibly by including this in their Corporate Social Responsibility (CSR) schemes. There are huge opportunities in poultry sector in India, if we could promote egg consumption from the current low level to higher levels.

Hoping for the best !

Mahesh

## Hart Jansson, Malnutrition Matters, Canada

Dear Moderator,

Eggs are a useful element in the challenging fight to improve nutrition. Let us not forget that there are also other plentiful foods that are as useful as eggs, and better suited to meet the challenge of sustainably improving nutrition for the Base of the Pyramid (BoP) where incomes are between $1 and $3 per day. As the attached brief (Cost of Protein in Africa) shows, the retail cost of protein provided via soy foods (either soy flour or locally produced soymilk/yoghurt) is less than half the cost of eggs. Soymilk can also be supplemented readily with low-cost micro-nutrient powders to provide Vit A,B,C,E, folic acid, iron and zinc , among others, to provide a super-nutritious, yet more affordable and highly accessible food supplement. Also, egg production uses several times more energy, water and land (to grow the chicken feed) than soybean cultivation for human consumption, and produces 10x greenhouse gas emissions, therefore is less environmentally sustainable.

Every possible solution to fight chronic malnutrition should be considered and deployed. There is no single food commodity that provides the solution, but let's keep our sights on accessibility, affordability and sustainability.

best regards,

Hart Jansson, President

Malnutrition Matters

## Colleen Farrell, CARE, United States of America

Around the world, women and young children bear the highest burden of undernutrition. The promotion of behaviors such as egg production and consumption for dietary diversification is a cost-effective and sustainable initiative to improve nutritional status in vulnerable groups. Chicken/duck-rearing and egg production can offer an additional source of household income, providing families with more resources to mitigate the effects of poverty and food insecurity.

As part of an innovative approach to substantially and sustainably improve nutritional outcomes for mothers and children, CARE implemented the Nutrition at the Center (N@C) project, a five-year global intervention aimed at reducing anemia in girls and women (ages 15-49) and stunting and anemia in infants and young children (0-23 months) by integrating maternal, infant, and young child nutrition (MIYCN); water, sanitation, and hygiene (WASH); food security; and women’s empowerment. Complementary programs in three of the four N@C countries – Bangladesh, Benin, and Ethiopia – focused specifically on homestead gardening, poultry-rearing, and egg production, with the goal of increasing egg consumption to improve dietary diversity and the overall nutritional status of mothers and children.

Key strategies to increase demand for eggs included: 1) utilization of improved chicken breeds and varieties that are resistant to disease and have higher egg yield, 2) utilization of low-cost, locally available chicken production systems combined with adequate disease control and health programs through supervision of agricultural extension service experts, 3) facilitation of cooking demonstrations to share new and locally acceptable recipes including eggs; and 4) advocacy for social behavior change in communities with existing taboos about egg consumption. Preliminary program end-line results indicate substantial improvements in dietary diversity among women and children in CARE’s intervention areas, as well as increased egg consumption:

In Ethiopia, N@C provided 1,000 resource-poor households with Bovans Brown layer chickens – a highly productive hardy breed – and monitored rearing practices with the help of agricultural extension service experts. Among members of 100 randomly selected households, 57% of children 6-23 months old reportedly consumed more than 4 eggs per week versus 7% at baseline, and 72% of lactating women versus 6% at baseline.

N@C: Homegrown, in Bangladesh, saw an increase in women’s egg consumption by 46 percentage points and nearly 60 percentage points (to 83.1% from 23.6%) with minimum dietary diversity; with the proportion of young children (6-23 months) having increased 51 percentage points and to 89.1% (from 32.6%) respectively. This was following the distribution of ducks to 3,000 of the poorest households in the intervention and provided trainings, through Farmers Nutrition Groups, on duck-rearing, homestead farming, maternal and child nutrition, and other pertinent topics.

In Benin, the combination of nutrition education and behavior change with the promotion of animal source food consumption produced positive results in almost all nutritional indicators among women and children with increased household dietary diversity, and the number of families feeding their children animal-sourced foods doubled. Most notably, findings showed that stunting among children increased by 5% in control sites, while program sites showed a 5% reduction in stunting rates indicating that the program activities, such as the promotion poultry raising, may be attributable to stunting prevention.

Overall, these encouraging results indicate that promoting egg consumption and building the capacity of households to rear egg-producing animals can have a significant impact on improving dietary diversity, and ultimately, the nutritional status of vulnerable women and children.

## Jean-Laurent Bungener, France

Eggs production has to be understanding with its ecological impact on ecosystem.

Three main product are produced, meat, manures (including feather), bones and eggshell. Production of eggs could also include protection against insect and little snakes.

On the other side quality of Eggs production is also a matter of grass, grain and water and veterinary constraint.

And finally to sell eggs you need to have good roads.

Eggs are easy to conserve for one month.

So egg production must be sustainable. This include selection and conservation of the best adapted variety of poultry,**Adapting production to seasonal variation**; and reusing all the by-products (bones, shell, feather, manures) with the best techniques (biochar etc..) and disposal of centre to manage eggs transportation and selling.

Producing poultry is a matter of nursery and predators, producing eggs is a matter of henhouse and pest.

So if we stand on those different facts; egg production could be use under three way.

Economic if you can sell them easily

Nutritional if they are for self-consumption during the "period de soudure" in the sahelian zone for example

Agronomic if you consider all the by-products you can use for crops production including crop protection against insects.

Reasoning on egg production could be established on the needs of a family. Then you could extend your production depending on grain and grass availability with a top production corresponding to one or two month after harvesting and a progressive reduction of poultry production till conserving just the youngest and best animals for the family and beginning nursery just two month before the beginning of top production.

This is to my view the best ways to use eggs in the benefits of the farmer.

## Mohamed Salih, Sudan University of Science & Technology, Sudan

**Producing Carotenoids and Selenium Enriched Eggs Using Herbal Plants for Nutritional Prevention of Chronic Diseases in Sub-Saharan Africa.**

Recently, a high degree of renewed interest is placed on the nutritional properties of herbal plants, which contain compounds with antioxidant activities such as Vitamin C, Carotenoids, organic selenium (Se) and flavonoids. There are claims in the literature that these herbs have nutritional, therapeutic and prophylactic properties due to their high level of antioxidants that are natural, highly bio-available and **inexpensive** compared to conventionally synthetic antioxidants.

Results of recent research at our laboratory at College of Agricultural Studies, Sudan University of Science & technology (Submitted for publication), demonstrated that using a local herb as feed additive in the diet of Single-comb White Leghorn (SCWL), show a numerically (not significant) increase in hen-day egg production and egg weight , but a significantly increase the egg quality parameters as measured by shell thickness, albumen quality of eggs storage for up to two weeks and yolk color as well as full bright feather coverage and significant improvement in primary and secondary immune response of the hens.

This Improvement in quality parameters will have the following advantages for farmers:

Improvement in eggshell strength will have a significant impact in the tropical countries since the high ambient temperature in this region is known increase eggshell breakage.

Recently layers laying cycle around the world is extended to well over 100 weeks. Therefore, eggshell breakage at old age can no longer be a limiting factor for this extension.

Color is one of the most important factors that affect consumer choices through sensory evaluation of food, a bright yolk color is considered as an indicator of freshness, good health, and performance of the flock. This bright yolk color is a value-added; especially in countries where poultry feed depends on sorghum as the main source of energy.

Excessive feather loss adversely affects feed conversion, as birds must allocate some of the available feed energy to compensate for heat loss. In addition, full and bright plumage cover will improve the welfare image of laying hens.

The herb immune-boosting agent can be used as a nutritional intervention tool to reduce antibiotic usage. Thus, meeting consumer demand for high quality, antibiotic-free poultry products.

The benefits of increasing the Carotenoids and Se content of the hen’s egg on human health

Particular interest in Se as antioxidants has been generated as a result of a number of studies showing that inadequate Se consumption is associated with poor health, genetic defects, Goiter and defense against (coronary heart disease and cancer) as well as various viral and bacterial diseases. The role of Se in human health and diseases has been discussed in detail in several recent reviews, with the main conclusion being that Se deficiency is recognized as a global problem. Therefore, finding a solution to this problem is now on the agenda of many government health bodies.

Carotenoids (lutein and Zeaxanthin) have been included recently into the antioxidants family. Evidence in several species suggests direct effects of lutein on the immune response.

Local herb natural and potent antioxidants (lutein and organic Se) would allow for the inclusion of omega-3 fatty acids into eggs and poultry meat since these natural antioxidants will protect omega -3 fatty acids from oxidation.

As a final conclusion, the information obtained from this study indicate that a designer egg-enriched in carotenoids and Se can be not only a good nutritional product but also a good vector for the delivery of two essential nutrients vital for human health. Additionally, we think that production of such enriched eggs will be a **bold idea** that could transform the way chronic diseases are treated in the developing world and may benefit the health of developed world citizens as well.

## Stella Kimambo, FAO, United Republic of Tanzania

I have been watching the conversation and would like to share good life stories of a miracle porridge mixed with eggshells. As African’s, we normally plate our hairs in different styles. On July 2018, I met with a woman (46 years old) on one of the saloons at Dodoma City Tanzania. She was carrying porridge on thermos. She said that, she normally takes this porridge because it has some miraculous power in it. When I tasted the porridge, it contained unique particles comparing to a normal porridge that we usually take.

The woman explained that she was unhappy for a while using medications because she was feeling pain in her neck and legs, but one of her friends introduced her to a blended porridge of egg shells, Bambara nuts, sorghum, and maize, soon after she started drinking the porridge she was released from the pain and she is doing fine. She normally mixes 4 eggshells (after washing them with clean water and let the shells sundry), 1kg Maize; 1kg Sorghum and ½ Kg of Bambara Nuts then she goes to a milling machine nearby to get a blended flour. She further explained that her grandmother (72) for a long time, was unable to walk due to serious pain at the back and on her legs, she relied on her family for help when needed to do any movement including going to the washroom, she was introduced to the miracle porridge and within 3 months, she was healed and she can walk and do her home activities. The porridge has become like a family meal used by some family members and friends such as Janet (74) who had neck pain, extremely stressful in the hospital and she was wearing the Neck Collar Brace without any relief but the miracle porridge helped her to work as usual, now she can carry a bucket of water and do normal routing work required. This recipe worked efficiently for Flora (53) suffering from knee pain. Being dependent, she used the porridge for three weeks and she was healed. Whenever she met anyone facing the same challenge she had, she introduced the recipe to a particular person and all were healed.

Based on this, I would suggest more research on this as well as improve strategies to mitigate challenges in poultry sector such as the source of raw materials for feeds and improve poultry breeder farms and hatchery facilities; strengthening of food safety and quality control mechanisms for better utilization for health population and economic growth.

## Taylor Wallace, Think Healthy Group, Inc., United States of America

Hi Everyone -

We recently published a manuscript "Eggs, choline, lutein and cognition across the lifespan."

https://www.ncbi.nlm.nih.gov/pubmed/29451849

There seems to be clear scientific evidence to suggest that both choline and lutein play a vital role in brain and neurological development during the first 1000 days post conception. We need other intervention studies around the world. One recent randomized trial in the US found effects of choline on cognition seven years after mothers were supplemented during the third trimester!

On the lutein side, it looks like macular pigment optical density is an inexpensive, noninvasive and fairly reliable marker of cognitive status, which could be important in some of these short-term intervention studies.

Taylor

## Sarah Wanene, Agrinovations Enterprises, Kenya

Campaigning for one egg per child is the way to go, especially in the rural parts of Africa. It is recommended that one needs a daily intake of protein and the most widely available and affordable protein is the egg. A practical example of my rural area: a 250g of meat is Kshs.120, well, considering the meat is to be taken by a family of 5 it will mean each one will have 50g of meat. The chances of the meat being well utilized by the body to reach the proteins full potential is minimal. The problem is this meat is not available daily it is bought in every two weeks or weekly this means it is not enough to cater for the recommended protein intake daily. An egg is cheaper going for Kshs.15 meaning for the same amount of Kshs. 120 the family can afford protein intake two times a week. This is almost guaranteed protein because one hard boiled eggs gives men up to 11 percent of the daily recommended intake and women get up to 14 percent of the recommended daily intake. Eggs are inexpensive and they are in high quality protein, vitamins and minerals.

To increase the availability of eggs in rural Africa calls for poultry rearing projects within the communities. The governments can be involved because the children are most vulnerable and if the governments could get to provide eggs in school, that way even the poorest get this nutritious commodity. So communities join together to have projects in turn the government is pushed to buy the eggs from the farmers then farmers earn some income and the children benefit both from home and school. Such projects like having food provided has kept children in school even when things are not looking up at home.

Kind Regards,

Sarah

## Olutosin Otekunrin, Federal University of Agriculture, Abeokuta, Nigeria, Nigeria

Dwelling on the aspect of this discussion (2) “What are the different ways that we could increase demand for eggs, other than increasing availability and reducing price? What are some examples of successful initiatives?”

The Nigerian Experience

One of the major initiatives explored by the government of Nigeria in improving the lives of the people is through the implementation of Home Grown School Feeding (HGSF) Programme which focused on providing food to school children (food based safety net programme) and this will indirectly help improve food security in the beneficiary households. The preparation of the meals will include the supply of protein rich foods like poultry products (mainly chicken and eggs). Demand for eggs will increase in this areas and other variety of food types where this programme is been implemented.

Children will benefit from a hot nutritionally balanced school meal; farmers will benefit from improved access to school feeding markets; and communities will benefit from new jobs across the supply chain such as catering, processing and food handling jobs. Besides the direct benefits, it is intended that HGSF can act as an important catalyst to drive (a) Agriculture-nutrition policies given the direct nutritional components of HGSF menus, and (b) Smallholder market participation with spill-over effects on broader public agriculture commodity procurement.

The main Objectives of HGSF programme are as follow:

1. The school enrolment and completion: The programme is aimed at improving the enrolment of primary school children in Nigeria and reduce the current dropout rate in primary school which was estimated to be 30%.

2. Child Nutrition and Health: The programme aimed at addressing the poor nutrition and health status of many children and thereby improving their overall academic performance (learning outcomes).

3. Local Agricultural Production: the programme aimed at stimulating local agricultural production and boost the income of farmers by creating a viable and ready market through the school feeding programme.

4. Creating jobs and improving family and state economy: The programme aimed at create jobs along the value chain and provide multiplier effect for economic growth and development.

HGSF programme is designed to provide minimum of one meal a day to each school pupil.

The Federal Government of Nigeria piloted the implementation of Home Grown School Feeding (HGSF) programme in 2004. The Federal Ministry of Education was the designated implementing agency for a phased-pilot rollout, beginning with 12 States and the Federal Capital Territory (FCT) selected from the six geopolitical zones.

Federal Government of Nigeria in collaboration with New Partnership for African Development (NEPAD), World Food Programme (WFP), United Nations International Children’s Fund (UNICEF), and other International Development Partners, developed the Home Grown School Feeding and Health Programme (HGSFHP). The programme was launched in September, 2005. Out of the 13 States that stated the programme in 2004, it is only Osun State that is still in full implementation of the programme. The State Osun HGSFHP, now known as Osun Elementary School Feeding and Health Programme (O-MEALS) commenced as a pilot programme in May 2006. Since 2012, the state has redesigned and funded it considerably to live to the aims and objectives of this programme among other states in the country.

Implementation of O-MEALS in Osun State

The state government worked with nutritionist in the tertiary institutions within the state for menu development for the programme. Large number of food vendors were identified from all Local Government Areas (LGAs), trained and empowered to prepare the meals in conducive and hygienic environments. Food materials are sourced from local farmers associations directly by food vendors.

Phase I: April 2012 with feeding of pupils in grades 1, 2, & 3

Phase II: Extended in December 2012 to include pupils in grade 4.

## Abdou Yahouza, CLUSA Projet sécurité alimentaire ARZKI, Niger

Original comment in French

Bonjour Chers Collègues,

Pour booster la consommation des œufs dans certains milieux ruraux, il faut poursuivre la sensibilisation des populations, combattre certains tabous, introduire la consommation des œufs dans les centres de récupération des enfants malnutris. Aussi plutôt développer l'élevage la production d'œufs des pintades qui sont plus consommées dans les villages que les œufs des poules. Former les petits producteurs notamment les jeunes et les femmes comment réussir l'élevage des pintades, car dans la plupart des marchés ruraux les œufs des pintades sont bien vendus et consommés en saison des pluies (période de production). il Ya même des réseaux de collecte pour ravitailler les centres urbains. Il faut aussi développer des systèmes de production d'aliments pour volaille à moindre coût en milieu rural et former des vaccinateurs vaccinatrices villageois pour l'accès à temps aux vaccins et antiparasitaires requis, notamment contre la maladie de Newcasle, la variole et le choléra aviaire, les ectoparasites et autres. Dans la mesure du possible développer la production et la commercialisation des pineaux et autres poussins en milieu rural.

Mes salutations

Abdou Yahouza

Livestock for Growth program in Mali

English translation

Hello Dear Colleagues,

To boost egg consumption in some rural areas, it is necessary to continue raising awareness, overcome certain taboos and introduce egg consumption in the recovery centres for malnourished children.

Also, rather develop the breeding and production of guinea fowl eggs, which are more consumed in villages than hen eggs.

Training small producers, especially young people and women, in order to successfully breed guinea fowl, as in most rural markets guinea fowl eggs are well traded and consumed in the rainy season (production period). There are even collecting networks to supply urban centers.

It is also necessary to develop low-cost poultry feed production systems in rural areas and train village vaccinators to ensure timely access to the required vaccines and antiparasitic agents, including Newcastle disease, smallpox and avian cholera, ectoparasites and others.

Where possible, to develop the production and marketing of pintels and other chicks in rural areas.

Best regards

Abdou Yahouza

Livestock for Growth program in Mali

## Tim Lambert, International Egg Commission, Canada

Dear Forum,

This has been both a fascinating and educational discussion, and I very much enjoyed taking part. Thank you all for your contributions, and for sharing your unique perspectives and thought-provoking questions. The case studies you have shared and your first-hand insights towards programs that deliver eggs to communities around the world around are evidence of the role eggs can take in addressing malnutrition and feeding our growing global population. In closing, I’d like to thank my co-facilitator, Saul Morris, and FAO FSN Forum for hosting this discussion and offering such a tremendous platform for discussion and debate.

Kindest regards,

Tim Lambert

## Saul Morris, Global Alliance for Improved Nutrition (GAIN), United Kingdom

I would also like to thank all the participants of this discussion for their thoughtful and informative posts.

It is clear that we have an enormous wealth of information available about how increase the consumption of this extraordinarily nutritious food.

I hope we can count on all of your help moving this agenda forward over the coming years.