



**Towards Eliminating Anemia in the High Andes:
Linking Social Protection with Agriculture and
Nutrition Interventions for Scaling: “Zero
Anemia”**

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Towards eliminating anemia in the high Andes: linking social protection with agriculture and nutrition interventions for scaling: “Zero Anemia”

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¹ Asociación Pataz (AP) is an NGO that has worked on different projects with CIP and was responsible for the extensive network of demonstration plots with advanced potato clones.

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Acronyms

AP	Asociación Pataz
CIP	International Potato Center
FAO	Food and Agriculture Organization of the United Nations
GNP	Good nutritional practices
HH	Household
IDRC	International Development Research Centre
IICA	Interamerican Institute for Cooperation in Agriculture
IIN	Institute of Nutritional Research
INIA	Instituto Nacional de Innovación Agraria
KAP	Knowledge, attitudes, and practices
MIDAGRI	Ministry of Agricultural Development and Irrigation
MIDIS	Ministry of Development and Social Inclusion
MINSA	Ministry of Health
PPH	Papas "Puño de Hierro"
PVS	Participatory varietal selection
SEPIA	Permanent Seminar for Agricultural Research
SO	Specific objective
SP	Strategic partner
SPP	Social Protection Programs
WFP	World Food Program

I. Summary

Through a gender-responsive pilot intervention, the Zero Anemia project contributed to (1) improving food security, nutrition, and gender empowerment in potato-based production systems in high Andean regions of Peru (Curgos and Julcan Districts, Sanchez Carrion Province, Department of La Libertad); and (2) developing agricultural and nutrition innovations in coordination with the social protection programs (SPP) Juntos² and Cuna Mas³, both overseen by the Ministry of Development and Social Inclusion (MIDIS), as well as with other stakeholders. This was a grant to the CGIAR Research Program on Roots, Tubers and Bananas for scaling agricultural and nutrition interventions using novel mechanisms and was implemented by the International Potato Center (CIP).

For more than two decades, child malnutrition in the Andean region of Peru has been very high and anemia remains a chronic problem with more than 50% of children affected by some type of anemia and 25% suffering of chronic malnutrition. Anemia in Curgos and Julcan increased in 2020 and 2021 from an already unacceptably high level, an indication of the impact of the COVID-19 pandemic on access to diversified food and the potential future deterioration of malnutrition indicators.

The Zero Anemia project developed a conceptual framework for scaling agriculture and nutrition interventions in a sustainable way by linking with social protection programs and other local partners. The strategy consisted in promoting a technical and institutional innovation package around improved nutrition through agriculture and scaling, enhancing linkages with social protection programs and local partners including municipalities, health centers and NGOs. The innovation package included iron and zinc biofortified potato varieties, nutritional education strategy and communication materials as well as institutional coordination with social protection programs and local partners. The pilot ag-nutrition intervention was implemented as a proof of concept for a novel approach to scaling in the Andes and included the following activities: (1) promote the planting and consumption of native potato varieties and advanced clones with high levels of iron and zinc in combination with other foods; (2) test a seed distribution voucher scheme to facilitate access to biofortified potato; (3) prioritize nutritional education for parents through health networks for the benefit of early childhood; and (4) support advocacy to generate scaling at different levels: local, regional and national. The institutional innovations were developed through the participation of one of the project partners, Asociacion Pataz, in coordination with platforms such as the Zero Hunger initiative of the Province of Sánchez Carrión, organized by MIDIS and the Local Articulated Instance (IAL). The institutional innovations also involved different social actors such as representatives of the Ministry of Health (MINSA), social protection programs and agrarian agencies to support actions for the prevention and reduction of anemia.

To evaluate the scaling potential of innovations developed with the Zero Anemia project, the main concepts of the "[Scaling Readiness](#)" approach were applied by CIP and its strategic partners, focusing on the innovation package promoted by the project. This links to a broader body of work around scaling biofortified crops as part of innovation packages in the RTB program (Low et al., 2022).

The project strengthened the collaboration between the field implementing partner, Asociacion Pataz, with the potato breeding program of CIP. Eight biofortified advanced clones of potato were evaluated during the project through participatory varietal selection with farmers (women and men). Seeds of the commercial native potato variety Huevo de Indio and of three selected biofortified clones were multiplied and distributed to the beneficiary families of the project, to assess them in their fields. This effort is contributing to the future release of more nutritious potato varieties targeted for the northern region of Peru when the formal evaluation process following the variety regulations will be completed in 2022.

² Juntos is a large-scale conditional cash transfer (CCT) program implemented in Peru since 2005.

³ Cuna Mas aims to improve early childhood development in children under three years old from poor and extremely poor areas, in order to overcome their gaps in cognitive, social, emotional, and physical development.



Figure 1. Educational material on nutrition promoting biofortified potato varieties.

A communication and nutrition education strategy was implemented as a complementary innovation, using gender-inclusive language focused on mothers of families. Taking advantage of the agricultural system of the households and aimed at tackling nutritional issues, messages were developed identifying diet improvements using locally available foods. The project has produced several educational materials following the findings and recommendations of the formative research and promoted the use of good agricultural practices including the use of biofortified potato varieties. The strategy to disseminate educational materials targeted parents from beneficiary households and local stakeholders, health clinics, social protection programs, municipalities, and the Ministry of Agriculture Development and Irrigation (MIDAGRI), who should continue to promote the diffusion of these materials. This strategy seeks the commitment of families regarding the importance of nutrition of young children. Asociacion Pataz has indicated its interest to use the project model and materials in its future interventions.

In addition, the project invested time and resources to design, implement and analyze two surveys (in 2020 and 2021) looking at the impact of COVID-19 on households' livelihoods in the intervention areas. Both surveys indicated that potato farmers were impacted due to disruptions in the commercialization channels that affected household incomes and consumption patterns with an effect on the family's food security and future investments in potato cultivation.

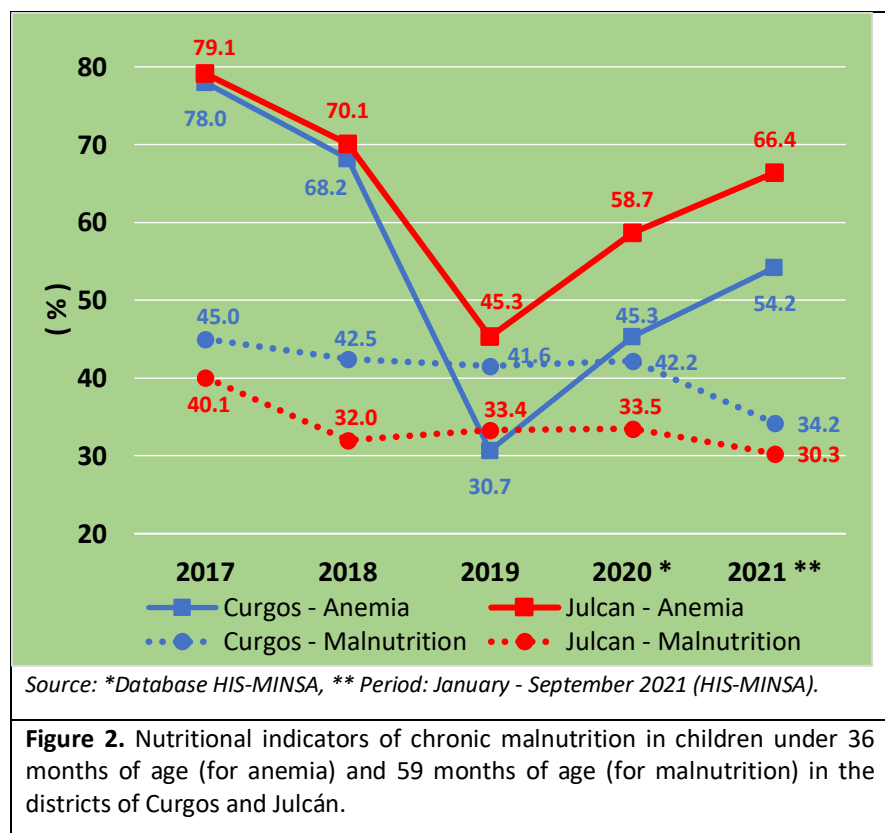
During 2020 and 2021, the challenges created by the COVID-19 health crisis were critical and affected the field activities implemented with the strategic project partners (Institute of Nutritional Research - IIN and Asociacion Pataz). Despite these challenges, the commitments of CIP and partners remained very strong and the project made important progress. Most project deliverables have been completed and the specific objectives of the project were achieved as well.

II. Background and project objectives

For more than two decades, child malnutrition in the Andean region has been very high and anemia continues to be a chronic problem with more than 50% of children affected by some type of anemia and 25% suffering of chronic malnutrition in Peru. To respond to the critical levels of anemia, the governments of Latin America, including Peru, have opted in recent years for the creation of Social Protection Programs (SPP) aimed at vulnerable populations with an emphasis on early childhood. These can be conditional income transfer programs (e.g., Juntos) or preschool feeding programs (e.g., Cuna Más), with the distribution of ferrous sulfate as a nutritional supplement to overcome anemia.

In 2020, levels of anemia in children in the Curgos and Julcan Districts of Peru increased to 45.3% and 58.7% respectively. Reports from January to September 2021 show an increase of anemia to 54.2% in Curgos and to 66.4% in Julcán, according to the Health Care System (Spanish acronym: HIS) and the Information System of Nutritional Status (SIEN) (Figure 2). These are some of the striking impacts that the COVID-19 health crisis and associated quarantine measures have had on malnutrition indicators. Lockdowns and the suspension of local markets limited the access to a diversified diet including foods of animal origin (liver, blood, beef spleen and fish), vegetables and fruits rich in micronutrients such as iron (Fe), zinc (Zn), vitamins A, and C, and have also disrupted the input and output supply chains (Vargas et al., 2021). Mobility restrictions also limited the continuation of many activities for reducing malnutrition that were normally implemented by different national and local government actors such as the SPP Juntos and Cuna Mas, Municipalities and MINSA. For example, pregnant women and mothers with children under the age of 5 stopped routine hemoglobin controls and screening. Many of the nutrition counselling programs were temporarily discontinued, affecting young children and their access to an appropriate diversified diet.

By the end of 2021, these activities were gradually being resumed through joint work between the MINSA, the SPP and other actors. However, the stabilization of the anemia trend observed in previous years and the increase in 2020 and 2021 (although data for this year is incomplete) reflect the vulnerability of progress obtained in the combat against anemia and malnutrition and the need for complementary and sustainable interventions.



Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. It is measured mostly through anthropometric indicators and therefore less variable in the short term. Anemia occurs when a person has an inadequate intake of iron and micronutrients or due to diarrhea, parasites, malaria, etc. Since it is measured through blood samples, the clinic condition can easily reflect rapid changes in the condition of the families and, if persistent, can impact malnutrition indicators in the longer run. Structural and family factors also influence the anemia condition of a household and these need to be understood to design effective interventions. Low family income, limited access to health services,

lack of sanitary facilities, low access and availability of diversified food sources and clean water, among others, are causes that require joint work by various public and private entities (Zavaleta and Astete-Robilliard, 2017).

Households often lack the information to recognize the importance of including iron-rich foods in their daily diet and only adopt iron supplementation as a palliative measure when symptoms of chronic anemia are present. Social Protection Programs, by themselves, are not enough to reduce this type of malnutrition, especially amongst the most vulnerable families. To strengthen and complement these macro-level interventions, actions in local territories and communities supporting food production and diet diversification approaches, as well as

nutrition education, are needed to improve nutritional outcomes of the Social Protection Program interventions. They represent a necessary complementary strategy that needs to be better conceptualized.

In most of the highland areas of Peru, potatoes are the main staple food and consumption can reach between 200 and 800 grams per day for young children and women, respectively (Rose et al., 2009). CIP has been working for over 15 years in the development of iron-biofortified potatoes to contribute to reduce malnutrition (Amoros et al., 2020). The currently available biofortified potato clones developed at CIP contain 40 to 70% more iron than regular commercial potato varieties (Salas et al., 2020). The first ever potato iron-bioavailability study in women from the Peruvian highlands demonstrated that iron from yellow-fleshed non-biofortified potatoes has remarkably high absorption (29%), being the highest across all Fe-biofortified crops bred by One CGIAR, and can cover up to 33% of the daily absorbed iron requirement of women of reproductive age (Jongstra et al., 2020). It is expected that iron-biofortified varieties will cover above 55% of the daily iron requirement. Other sources of iron are required to complement the contribution of potatoes, including foods of animal origin such as guinea pigs and eggs, which are part of local production systems, and a diversified diet, which is accessible through higher income.

The goal of the Zero Anemia project was to design and test a pilot intervention and develop a gender responsive strategy to strengthen agriculture-nutrition linkages to combat childhood anemia in the high Andes of Peru.

The project was implemented following four specific objectives:

1. Adapt a conceptual framework for gender-responsive scaling of agricultural innovations to reduce anemia in Peru.
2. Design and implement a pilot intervention in target territories.
3. Evaluate results of the coordinated intervention with participating institutions.
4. Generate policy recommendations for the implementation of the scaling framework in Peru.

The activities implemented in the project contributed to develop and analyze innovations, both technical and institutional, to strengthen the link between agricultural production systems and food systems to improve food security for the most vulnerable rural families in high Andean regions of Peru (Curgos and Julcan districts, Province Sanchez Carrion, Department of La Libertad) through gender-responsive pilot interventions.

III. Target groups and scope of intervention

The Curgos and Julcan districts in La Libertad region represent similar agro-ecological conditions of the high Andean region (Figure 3). The target population of the project included 240 households (140 in the intervention group and 100 in the control group) that were in an economically vulnerable situation. All the activities, in both nutrition and agricultural production were implemented in close collaboration with two strategic partners, the Institute of Nutritional Research - IIN (<https://www.iin.sld.pe/>) and Asociacion Pataz (<https://www.asociacionpataz.org.pe/>). CIP research programs, particularly the Genomics, Genetics and Crop Improvement Division (GGCI), and local stakeholders also played major roles in different activities. Despite the emergency response due to the health crisis, commitments from partners remained very strong throughout the project implementation period, both from IIN contributing with nutritional education expertise and Asociacion Pataz implementing field activities with project beneficiary families.

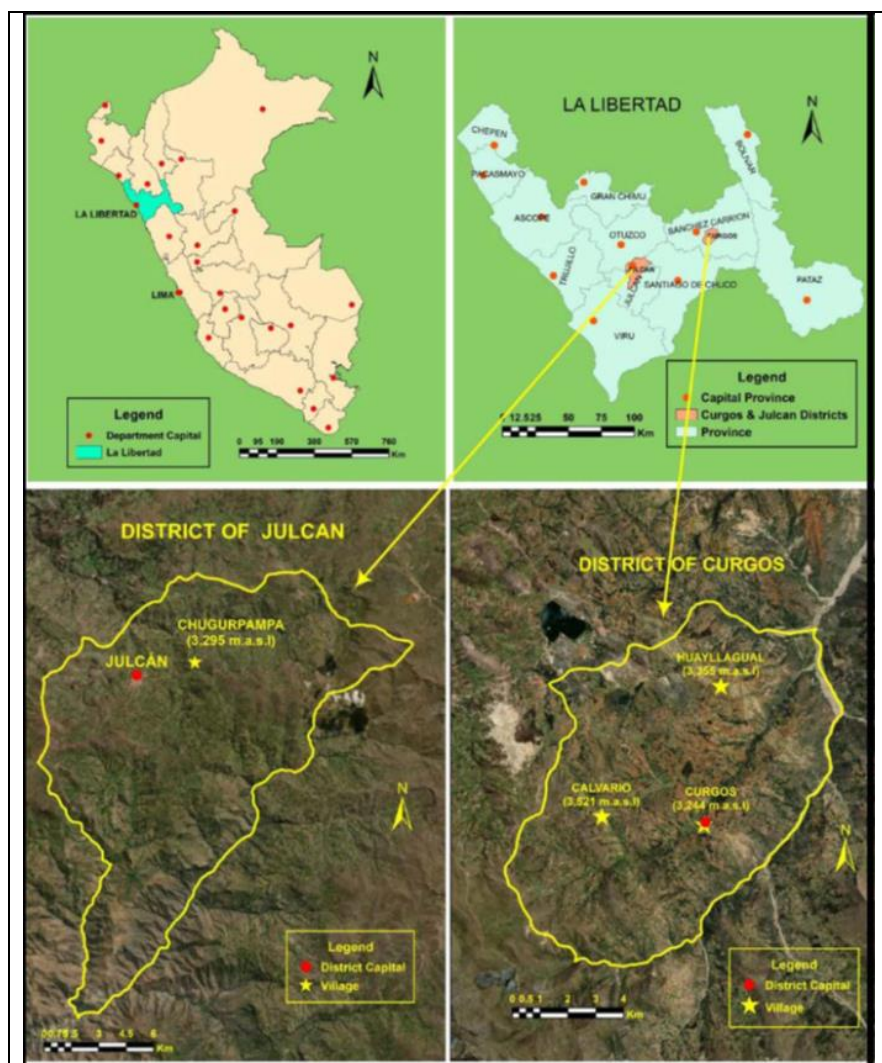


Figure 3. Location of the communities and intervention districts.

The project activities were coordinated with the social protection programs Cuna Mas and Juntos, health clinics, municipalities, agrarian agencies, local authorities and farmers' associations, representing nearly ten public and private institutions of the health and agriculture sector and involving around 20 professional staff. The social connections in the municipalities are important to help link with different actors who needed to coordinate health, nutrition, and agriculture production issues, particularly under the situation of COVID-19 context that limited interactions, meetings, and face-to-face contacts among stakeholders.

When possible, the project continued to support the development of networks involving public and private actors, to strengthen capacities and interaction for the development, application and dissemination of Good Nutrition Practices for early childhood and to influence public policies to create an enabling environment for the responsible

scaling of innovations.

A complete timeline of the project activities for the entire duration of the grant is presented on the following page (Figure 4). Each activity is linked to the specific objective of the project based on their contribution to the achievement of those objectives.

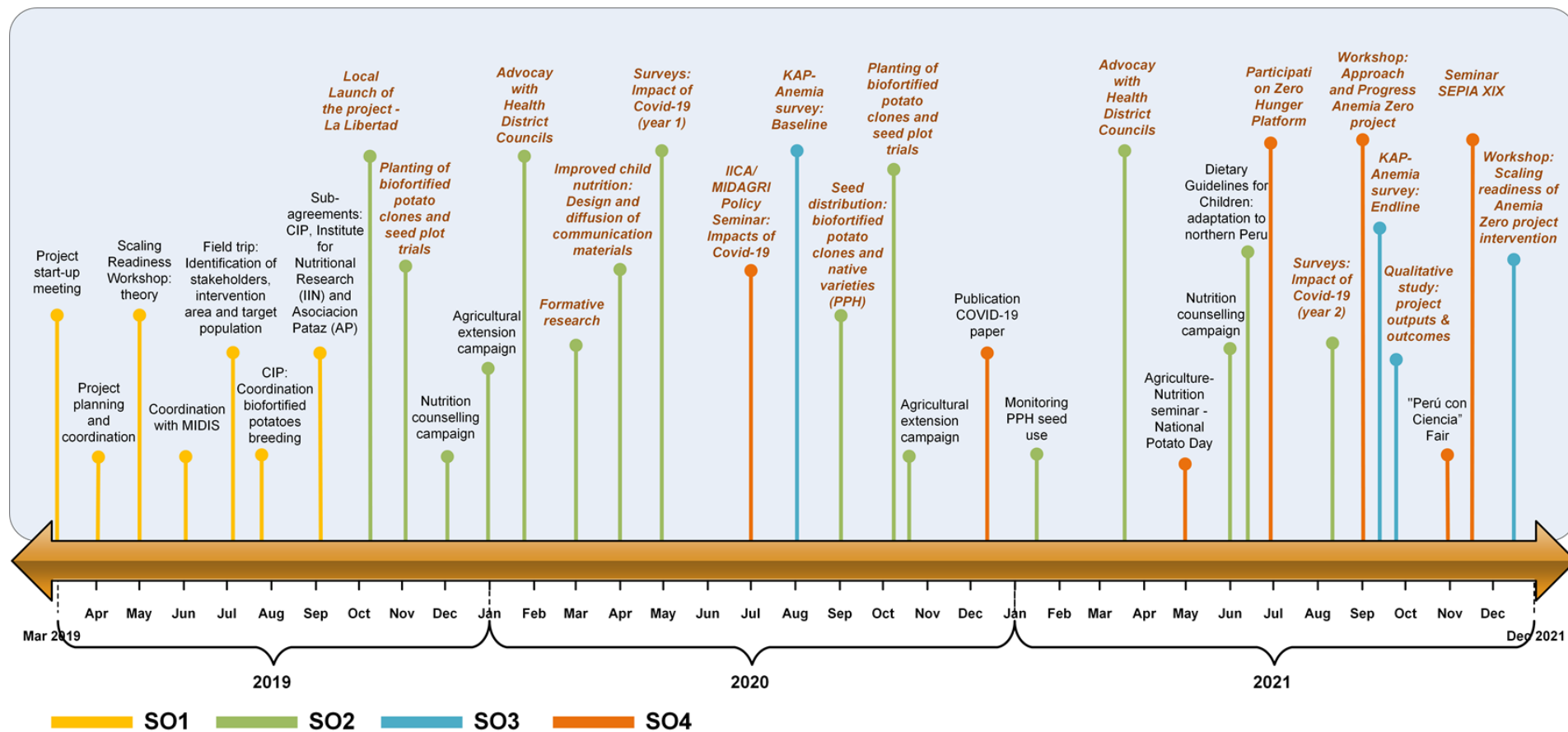


Figure 4. Timeline of project activities and key milestones, entire grant duration (March 2019–December 2021).

IV. Progress towards achievement of general and specific objectives (SOs)

The four main components of the project were linked to the specific objectives and were organized around a pilot intervention, with the objective of enhancing the interaction between agriculture and nutrition programs in the local territories to help reduce the incidence of anemia in vulnerable populations. The project activities and results achieved between 2019 and 2021 are presented under each of the four specific objectives (SOs). Given the quarantine restrictions implemented in Peru since mid-March 2020, the project team included additional activities to learn about the impact in the intervention area and to adapt the project strategy. The project invested time and resources to design and implement two surveys, one in 2020 and a follow-up in 2021, looking at the impact of COVID-19 restrictions on household livelihoods in the intervention areas.

4.1. SO1. Adapt a conceptual framework for gender-responsive scaling of agricultural innovations to reduce anemia in Peru.

The project developed a conceptual framework for scaling agriculture and nutrition interventions in a sustainable way by linking with social protection programs and other local partners. To improve food and nutrition security for the most vulnerable rural families, the strategy consisted in promoting an innovation package, both technical and institutional, around improved nutrition through agriculture and scaling including nutrition and health education, farming practices, potato seed systems, and advocacy for cross-sectoral integration (Figure 5).

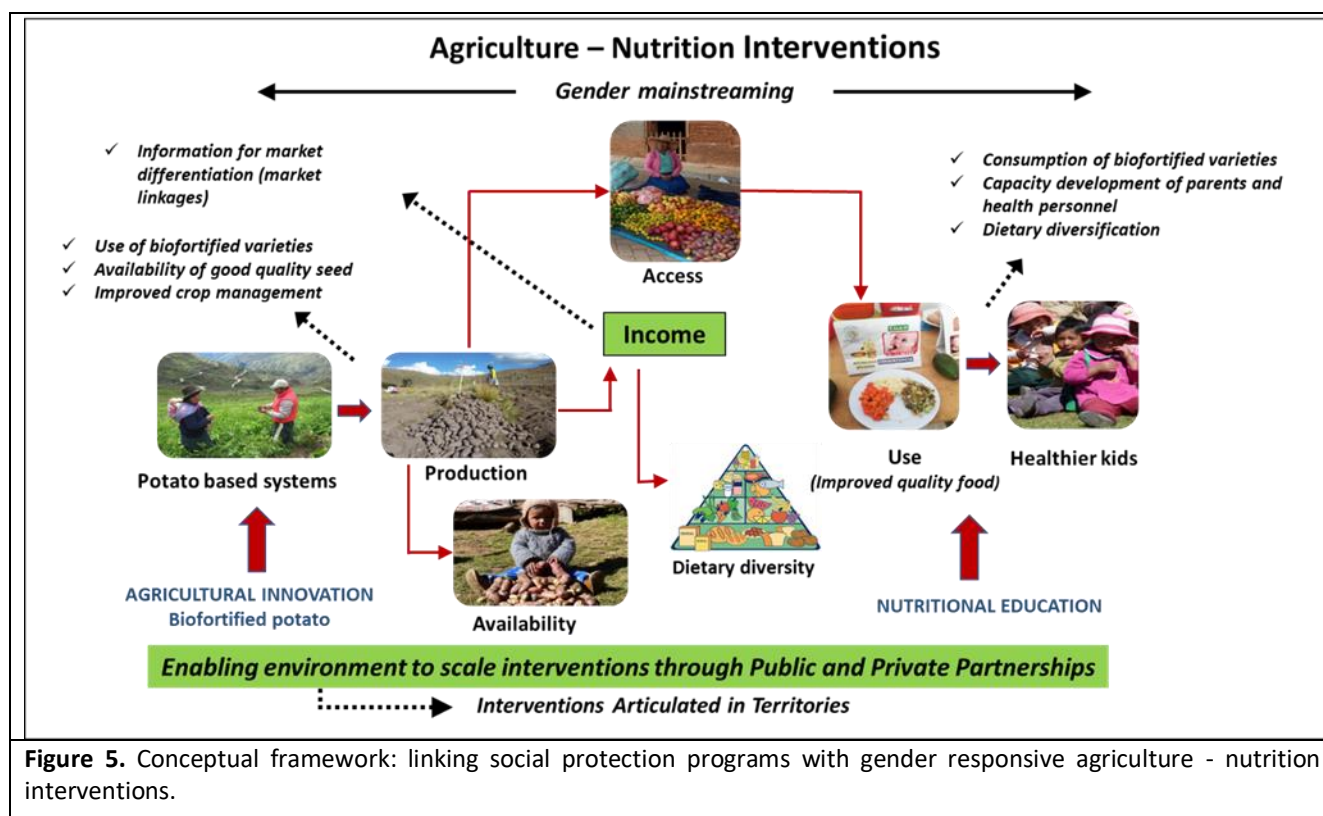


Figure 5. Conceptual framework: linking social protection programs with gender responsive agriculture - nutrition interventions.

Operationally, the interventions involved working with four components:

- innovations in potato production for nutrition, promoting the use of varieties with higher Fe content;
- improvement of potato-based production systems;
- promotion of nutritional education for mothers through health networks for the benefit of early childhood;
- sectoral articulation in local territories through public communication and advocacy at different levels: local, regional and national.

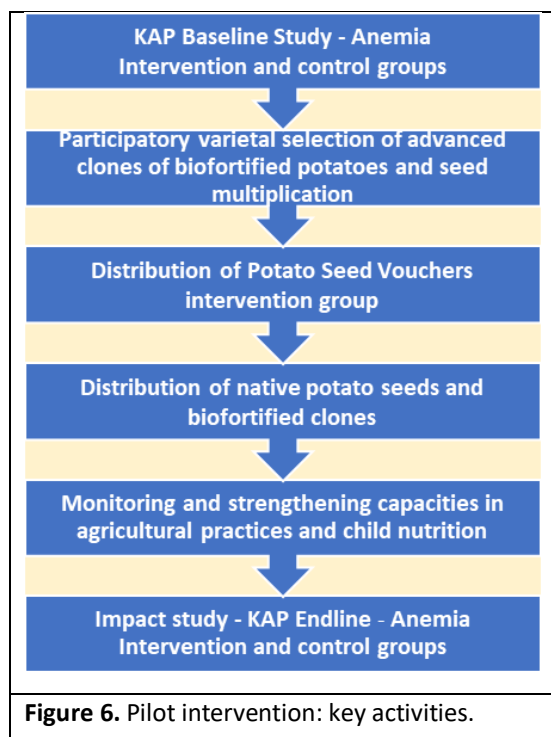
The pilot intervention was implemented by the project staff members with its strategic partners and in coordination with social protection programs and other local actors.

The agriculture and nutrition pilot intervention included six key activities: 1) baseline survey about knowledge, attitudes, and practices (KAP)—Anemia (based on FAO KAP—Anemia survey); 2) participatory varietal selection of advanced biofortified potato clones; 3) design and distribution of a seed voucher system; 4) distribution of seeds of biofortified potatoes; 5) interventions targeting Good Nutritional Practices for infants; and 6) endline survey to monitor and evaluate changes on KAP—Anemia indicators. Complementary institutional innovations were implemented through the participation of the Asociacion Pataz team in the Local Articulation Instance platform. This platform supported planning and actions towards the prevention and reduction of anemia together with partners led by the local government institutions and social protection programs. The project promoted technical knowledge and capacity development for potato production and nutritional education on the use and consumption of diversified diets including biofortified potato varieties.

A communication strategy was developed around targeted recommendations to foster equitable access to agriculture and nutrition information and innovations in the pilot intervention sites. The communication materials use an inclusive and explicit language to foster women's engagement and participation in decision making about agricultural production where they are often less visible, and to integrate men in the learning sessions about good nutritional practices that are traditionally perceived as the women's domain in the local context.

The COVID-19 pandemic affected the project support, interaction and coordination with stakeholders at different levels (local, regional and national) including the agricultural sector in the regions and the social protection programs. Enhancing existing local networks and articulation mechanisms with stakeholders remained a priority until the conclusion of the project. This coordination helped to promote and support the educational campaign about the nutritional contribution of biofortified potatoes. The local social network is another key factor to be considered when analyzing scaling strategies. Finally, the current state of development of technological and institutional innovations were analyzed based on their scaling potential, with the objective to identify weak spots and the necessary actions required to adjust future interventions.

4.2. SO2. Design and implement a pilot intervention in target territories.



The contribution of the strategic partners has been very strong, both from IIN with its nutritional education expertise and Asociacion Pataz coordinating field activities for the pilot intervention. Having strong partners for field and analytic activities has helped to minimize disruptions due to COVID-19 and to keep the project on track as much as possible to achieve important deliverables.

The objectives of the pilot intervention were to enhance the interrelationship between agriculture and nutrition to combat childhood anemia. One important component was the introduction of new biofortified potato clones, high in micronutrients such as iron and zinc, which can provide up to 31% of a child's daily iron requirements. The pilot intervention was coordinated by the project with its partners and supported by formative research on practices, knowledge, motivation, and attitudes regarding complementary feeding of children from 6 to 36 months old and the communication and education strategy. It was organized around six key activities (Figure 6), each implemented under specific methods by selected stakeholders (Table 1).

Formative research was conducted with the objective of understanding current practices and cultural beliefs about anemia and its causes and households' availability and access to, for example, local foods that could complement and form the basis for more nutritious diets. The research also gathered information that was used to tailor the nutrition communication campaign to local culture. Field work was being implemented in March 2020 and had to be interrupted because of the quarantine measures implemented by the Government of Peru to face the COVID-19 emergency. The decision was made to continue through phone surveys with local stakeholders of the health sector and SPP as well as with mothers of small children. Data were also collected through informal conversations with local experts. The research was complemented with a Communication and Education Strategy for Families and Health Agents.

Table 1. The pilot intervention key activities, methods and partners.

Activities	Methods	Partners and allies	Date
1. Baseline KAP-Anemia survey	* Initial survey on Knowledge, Attitudes and Practices (KAP) - Anemia. Intervention Group: 142 families (111 women and 31 men) and Control Group: 100 families (88 women and 11 men)	Strategic partners (SP): Instituto de Investigación Nutricional (IIN) and Asociación Pataz	November 2020 and January 2021
2. Participatory varietal selection of advanced biofortified potato clones and seed multiplication	Installation of 2 experimental plots with 8 potato clones (1,000 m ²) for participatory selection with local technicians and producers.	Potato breeding program-CIP, Asociación Pataz, Agrarian agencies Curgos y Julcán	November 2019 to November 2020
3. Seed voucher distribution for native and biofortified potato varieties	Distribution of vouchers to registered families in Juntos and Cuna Mas Programs	Strategic partners (SP) alliance with SPP and Health services in Curgos and Julcán.	November 2020
4. Distribution of native commercial and biofortified potato seed	Coordination for the distribution of 10 kg of potato seeds to parents through the exchange of vouchers	Alliance of SP with Curgos and Julcan Municipalities and Agrarian agencies	November and December 2020
5. Monitoring and strengthening capacities in agricultural practices and child nutrition	Final Survey on KAP-Anemia. Intervention and Control Groups	SPs in collaboration with Social Protection Programs and Health services, Agrarian Agency and Curgos y Julcán Municipalities	October 2021
6. Impact: Endline KAP-Anemia survey	* Final Survey on KAP-Anemia; comparison between Intervention and Control Groups	SPs: Instituto de Investigación Nutricional (IIN) and Asociación Pataz	November 2021 to January 2022

* Due to culturally accepted roles, men are often not engaged in feeding and nutrition practices so both for the baseline and endline anemia surveys the team in the field purposefully incorporated men but achieving full gender balance was not possible.

4.2.1. Formative research study

The objectives of the study were to:

1. Gain knowledge about the availability and consumption of food in the intervention area.
2. Carry out a qualitative diagnosis on current nutrition practices of infants and pregnant women.
3. Understand the perceptions, valuation and use of food high in micronutrients such as iron among caregivers of children under 3 years of age.
4. Identify opportunities, messages, and communication channels to strengthen the project intervention.

The characterization of nutritional practices was carried out by applying a 24-hour qualitative recall survey and the weekly frequency of food intake. It was complemented with interviews to health clinic personnel, local authorities, personnel from the Cuna Más social protection program, a focus group with mothers, and a group conversation with farmers (both women and men). At the same time, local food markets and stores were visited to record the availability and consumption of different foods in the project sites. The field survey was interrupted because of the national lockdown due to COVID-19. The remaining interviews were carried out through phone calls and included 16 mothers of 6- to 36-month-old children in the districts of Curgos (11) and Julcan (5). It is important to highlight that although the project targeted parents in general, the team was not able to identify fathers who were directly engaged in caregiving. Therefore, it was mainly mothers who were engaged in focus group discussions and phone call interviews. Table 2 presents major recommendations arising from the research.

Table 2. Summary of the recommendations resulting from the formative research.

Nutritional practices recommended	Foods to promote	Motivations and messages
Increase the meal consistency	Mashed, biofortified potato with liver	A new potato variety will give us a better production and better nutrition
Increase consumption of animal source foods	Eggs, fish, and chicken liver	A good future for children is not having anemia in the present
Encourage consumption of dark green leaves	Young leaves of quinoa, broad bean, olluco, spinach and watercress	With potato, egg, fish, liver, green leaves, children grow up healthy and strong
Reinforce the continuity of fruit consumption (Vit. C)	Orange, tumbo, tangerine, aguaymanto, bananas	We want a boy or girl with all their potential and personality

In both districts, families could rely on broad farm-produced food diversity, with potato being the most important food produced and also contributing to income generation. In terms of availability and access to food, there were no perceived situations of food insecurity in both districts. However, animal-sourced foods are the most expensive and least available food items in the family diets and, therefore, amongst children between 6 and 36 months of age. This is an indication of the limitations to access and to achieve adequate dietary diversity for families in both districts. Consumption of iron supplements was also found to be very limited, from the children consumption 24-hour recall story. To maximize access to nutritious food based on existing levels of family income, the project team recommended the purchase of animal-source foods such as eggs at least once a week. Another recommendation was to accompany egg consumption with dark green leaves of quinoa, broad beans and watercress. The reasons underlying the reported low consumption of iron supplements needs further analysis.

The formative research was complemented with recommendations for a Communicational and Educational Strategy for Families and Health Agents with the objective of enhancing complementarity between agricultural and nutritional interventions to combat anemia. A specially designed Nutrition-Agronomic calendar developed

by the project contributed to transmit basic messages about good nutritional practices for infants as well as messages about potato crop management. In the learning sessions, the recommendations of the formative research were integrated to reinforce the topics recommended by MINSA, such as: healthy eating, anemia in pregnant women and children, breastfeeding, and food safety. Demonstrative food preparation sessions were also held to promote the consumption of Fe-biofortified potatoes in combination with animal source foods and local products such as quinoa, vegetables, and fruits as a source of vitamin C. The sessions were attended in person by a total of nine health agents, 32 community agents and 78 mothers of families; 49 additional mothers participated remotely.

While local gender norms assign women with caregiving and nutritional roles, the project carefully included subtle messages where both women and men appear in the images performing different care giving and nutritional roles in the guides and communication material. Furthermore, the project team paid special attention to foster the engagement of men in nutritional messaging by identifying spaces (mostly agronomic related) where men were also able to access nutritional information and receive capacity building.

4.2.2. Baseline survey: knowledge, attitudes and practices (KAP-Anemia)

1. Agriculture characteristics of the project intervention areas

The KAP-Anemia study is quasi-experimental, quantitative, based on primary information with a comparative purpose to establish differences between the intervention and control groups and the effects of the intervention, contrasting the baseline with the final measurement (endline).



Figure 7. Demonstrative food preparation sessions in Curgos (before quarantine restrictions started).

The sample was selected, with the sole criterion of identifying the group of mothers/caregivers with children under three years of age who are part of the care registry of the Juntos social protection program: 142 mothers from the intervention group and 100 from the control group, who voluntarily agreed to participate in the study.

As part of the baseline study on knowledge, attitudes and practices in anemia (KAP-Anemia), the project also collected information on the agriculture production system of the households in the project sites through semi-structured interviews (intervention and control).

The results show that, on average, households cultivate small areas of land, less than one hectare, without irrigation; the average cultivated area of the intervention group is 0.54 ha, and 0.22 ha of the control group, respectively. Several crops are grown (Figure 8), including tubers, grasses and legumes; with potato occupying the largest area (0.31 ha planted by the intervention group and 0.12 ha by the control group).

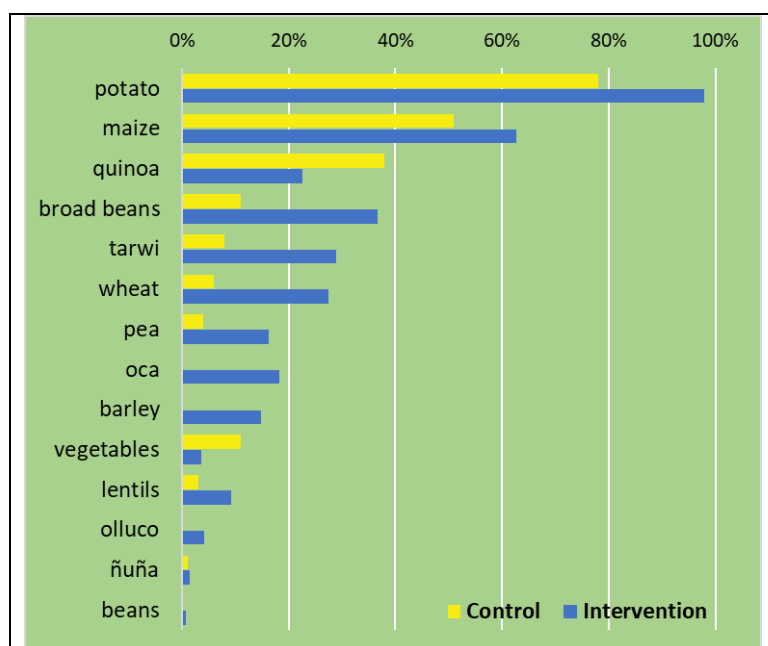


Figure 8. Crops planted by households of the intervention and control groups.

Since the cultivated areas are small, the volume of potato production is also low. The intervention households produce on average of 3.07 tons and the control group around 2 tons of potatoes per year. The commercial potato variety Amarillis is the most popular variety, grown for both commercial and own consumption purposes; 86% of households in the intervention group sold an average of 2.67 tones, while 66% of households in the control group sold 1.39 tons of potatoes as a source of income. Another variety of relative importance is Huevo de Indio, a native variety of good culinary quality with high content of micronutrients (iron and zinc), produced mainly for own consumption (CIP, 2015). Nearly 30% of households in the intervention group planted this variety, although it was planted by very few households in the control group.

Animal husbandry, as well as crop management, is an important activity for all type of households, with 90% of families owning livestock, including small livestock such as guinea pigs, chickens, rabbits and ducks. Large livestock includes cows, sheep and pigs. A total of 70% of families raise guinea pigs, around 60% have chickens, and sheep are raised in 60% of the families in the intervention group and 50% of the control group. Less than 25% of families have cows, which were mainly listed in the intervention group. Livestock are raised for both family consumption and for commercial purposes. About 40% of households in the two groups had access to animal protein for consumption consisting of: three guinea pigs, a hen and a sheep. Owning chickens and cows allows families to have access to eggs and milk. Likewise, the sale of livestock represents an important source of income, particularly for households raising cattle, sheep and pigs, given the high commercial value in local markets.

2. Baseline survey about knowledge, attitudes and practices (KAP)

The design of the baseline survey was based on FAO's KAP-Anemia module and questionnaire and was adapted by IIN using results of the formative research. The final version of the KAP-Anemia survey questionnaire was approved by IIN's Research Ethics Committee in September 2020.

The specific objectives of the survey were:

- To determine the level of knowledge about anemia in mothers and fathers of children < 36 months old.
- To understand the consumption patterns for children < 36 months of age.
- To identify consumption practices of high Fe-content foods to prevent anemia in children < 36 months of age.

The final tool included 54 questions concerning anemia and 19 questions about potato cultivation (see KAP-Anemia database for access to full questionnaire). The surveys were conducted by Asociacion Pataz between November 2020 and January 2021 and were implemented through phone calls. When families lacked access to a phone line or cell phone, they were visited by project team members, applying COVID-19 protocols developed by Asociacion Pataz and CIP (see Annex 7 and <https://tinyurl.com/4cf2d5yz>). The team purposefully sought to equitably include both women and men in the sample.

The study sample consisted of 242 parents/caregivers (142 = intervention group and 100 = control group) belonging to the Districts of Curgos, Julcan and Huamachuco in La Libertad region, who voluntarily agreed to participate in the study. We found that the majority of those interviewed were female for both groups (78.17%

in the intervention group and 88% in the control group), mainly due to local gender roles where women are mainly in charge of caring for children and their care feeding. The surveys were conducted through both telephone and face-to-face interviews since some households do not have access to a cell phone or telephone signal.

The survey analyzed characteristics of households interviewed (mother, father, and children). In both groups (intervention and control) the father's main economic activity was agriculture. More than 90% of the households were growing potatoes, which is used to feed early childhood children (Figure 9).

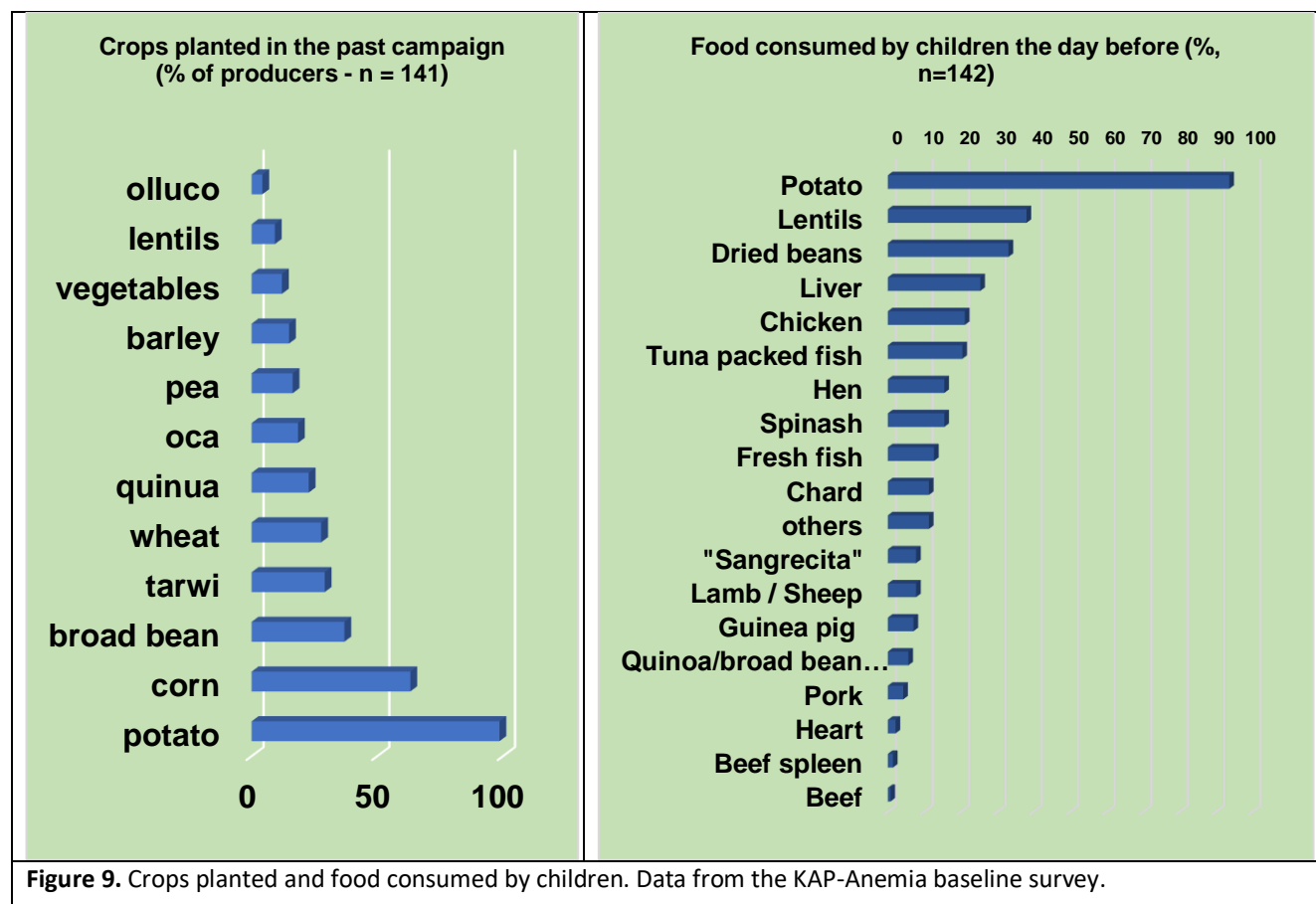


Figure 9. Crops planted and food consumed by children. Data from the KAP-Anemia baseline survey.

Table 3. Knowledge about anemia in the intervention and control groups.

Group	Knowledge					
	Good		Moderate		Bad	
	n	%	n	%	n	%
Intervention	5	3.52	29	20.42	108	76.06
Control	0	0.00	8	8.00	92	92.00

Table 3 compares the knowledge about anemia in both groups. The results highlight that the majority of parents are unaware or lack information about anemia, which could imply inappropriate infant feeding practices. The control group awareness is lower than the intervention group. Despite having little or deficient knowledge regarding anemia, parents have favorable attitudes towards the importance of preventing anemia when feeding their children (Table 4). This represents an entry point that could be reinforced during nutrition counselling sessions and capacity building with mothers.

Table 4. Attitudes towards anemia in intervention and control groups.

Group	Attitudes			
	Positive		Negative	
	<i>n</i>	%	<i>n</i>	%
Intervention	113	79.58	29	20.42
Control	57	57.00	43	43.00

Parents are unaware of the consumption of adequate food and the importance of the variety of food sources rich in iron, mainly of animal origin (fish, liver, little blood, red organism, red meat and poultry) in combination with vitamin-C-rich foods. The majority of households (49.29%) in the intervention group perform regular practices against anemia. While in the control group, the majority (74%) perform inappropriate practices (Table 5).

Table 5. Feeding practices against anemia in the intervention and control groups.

Group	Practices					
	Adequate		Regular		Inadequate	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Intervention	8	5.63	70	49.29	64	45.07
Control	0	0.00	26	26.00	74	74.00

With these results, it can be deduced that parents, despite having initial little or deficient knowledge regarding anemia, have favorable attitudes at the time of feeding their children. Promoting nutritional education in an interdisciplinary and intersectoral manner, with simple and key messages adapted to local culture, was important to improve knowledge and attitude regarding anemia. This attitude can be reinforced through nutritional education at health centers and home visits to

accompany mothers of children under 3 years of age.

4.2.3. Participatory varietal selection of advanced clones of biofortified potatoes and seed distribution of native commercial and biofortified potato seed using vouchers



During the 2019/2020 agricultural season, the CIP breeding program led by the GGCI Division in coordination with the Zero Anemia project installed two experimental plots with eight advanced biofortified potato clones in the intervention area. At harvest in June 2020, three clones were chosen through participatory variety selection (PVS) involving technicians and groups of local farmers. Selection criteria included agronomic and morphological characteristics (tolerance to pests, plant architecture, productivity, tuber size, tuber shape, tuber flesh color), and organoleptic characteristics (taste, texture). Nutritional evaluation, including iron content, was also considered. Experimental plots with the three advanced clones were installed in November 2020 for a second season, following the authorization of INIA (*Instituto Nacional de Innovación Agraria*) and as part of the process required for the release of a new potato variety in Peru. The plots were harvested in May–June 2021 and results are being analyzed to complete the registration and release process. A meeting of the CIP team is planned for April 2022 to decide which of the advanced clones will move into the registration phase.

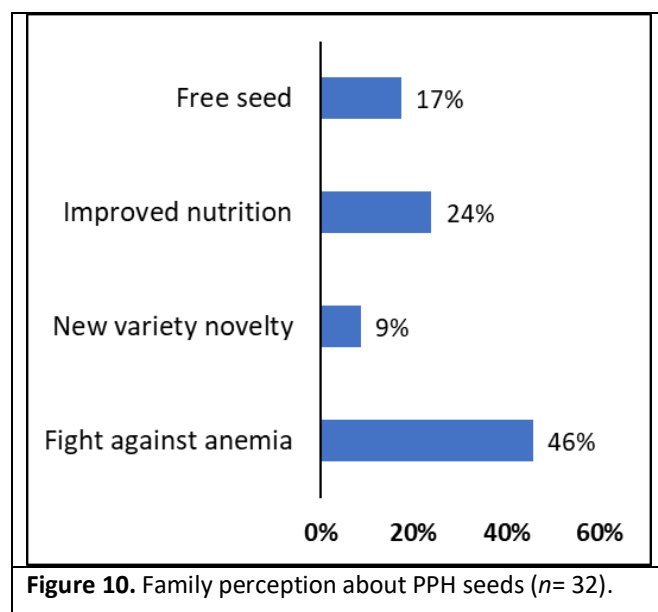
An innovative seed distribution model through a voucher system, adapted from a similar system developed for sweetpotato in Africa (Girard et al., 2021), was designed by the project team and tested in partnership with national social protection programs and other local actors, targeting vulnerable families with children under three years of age. It was used to distribute seeds of three selected clones mentioned above (see details in Table 6). The project also distributed seeds of the native variety *Huevo de Indio* presenting a high Fe content and demand in local markets. These genetic materials were named Iron Fist Potatoes (PPH, acronym of the Spanish denomination *Papas Puño de Hierro*), and a promotional campaign was carried out to encourage their planting in the intervention area. Special vouchers were designed with a representative figure of a child's fist holding potato seeds and accompanied by a striking message: "We are the iron fist potatoes supporting you against anemia and to become healthy and strong sowing for the future" (Annex 1).

With the participation of local health agents through the health clinics, the vouchers were delivered to a total of 143 mothers of the Juntos and Cuna Mas Social Protection Programs, who later exchanged the vouchers for seeds at the agrarian agencies and in the Municipalities (Annex 2). Each family had access to 2 kg of seeds from

the three biofortified clones and 3 kg of Huevo de Indio seeds, which they planted and cultivated in their potato fields with the advice of Asociacion Pataz.

Table 6. Basic characteristics of the three biofortified potato clones compared to commercial variety Yungay (DW = dry weight).

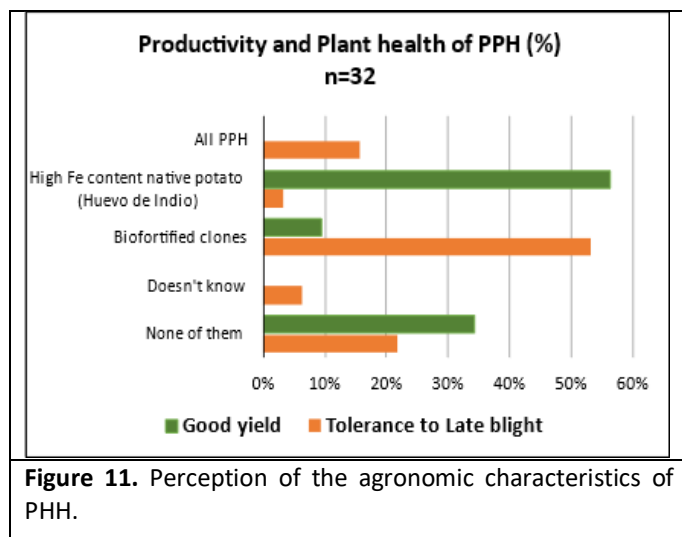
	BIOT-721.245	BIOT-725.047	BIOT-721.074	Yungay
Selection Criteria				
Vegetative development	X		X	
Organoleptic	X	X	X	
Productivity (t/ha)	24.0	23.9	24.3	28.0
Fe (mg/Kg DW)	19.9	22.5	17.8	13.3
Glycoalkaloids (mg/100g. DW)	0.22	2.85	0.64	0.56



The seeds of the biofortified clones and the native variety were packed in 5 kg mesh bags and distributed to the 143 participating households, with Asociación Pataz overseeing the distribution together with local partners such as the District Municipality and the Ministry of Agriculture. The distribution of potato seeds was accompanied by a flyer with information about the agronomic and nutritional characteristics of the biofortified clones and native varieties and their potential contribution to the reduction of anemia (Annex 3). The crop was monitored by Asociación Pataz who gave technical assistance to farmers. During the harvest in May–June 2021, further evaluation of the clones was implemented to assess both quantitative (yield) and qualitative (acceptance by families) characteristics.

A sample of 32 households from the intervention group was monitored with the aim of collecting relevant information about the perception of family members about the Iron Fist Potatoes (PPH). All the interviewed participants stated that they exchanged the PPH seeds with the vouchers and that they planted these seeds in their potato fields. The results of the monitoring survey are mostly qualitative and provide preliminary information about the acceptance and potential future adoption of the PPH. Results include the perceptions of mothers with respect to the nutritional, agronomic and culinary aspects of PPH, and their intention to continue planting them in the next agricultural season (Figures 10 and 11).

Regarding productivity, 56.3% stated that the Huevo de Indio variety had good performance; while 34.4% found no differences between this variety and the biofortified clones; and 9.4% had a favorable perception of the biofortified clones only. Regarding health, 53.1% stated that the biofortified clones presented tolerance to late blight, the major potato crop disease; a smaller group of families (21.9%) found no differences between the variety and the clones. A higher percentage of participants, around 80%, referred to the native variety Huevo de Indio, while the biofortified clones were appreciated for their resistance to late blight.



The expectations for a new potato variety are high and the understanding of its potential nutritional advantage is now clear. However, the expectations include prospects for commercial sales since the main economic activity of the households is sale of potatoes to supply local Peruvian markets. This is relevant, since it could become a critical limiting factor of the scaling process if some of the new varieties lack market potential. This variety selection effort developed through the project is contributing to the future release of more nutritious potato varieties targeted for the northern region of Peru when the formal evaluation process following the variety regulations will be completed and

registration will begin (second semester 2022).

4.2.4. Nutritional education materials promoting Good Nutritional Practices for infants

In a highly participatory manner and following the findings and recommendations of the formative research, the project has produced educational materials to promote good nutritional practices for infants. They include simple and high-impact messages through the use of metaphors that link agricultural and nutritional elements, with inclusive language and graphics that have embedded elements of gender equality. For example, the calendars have graphics where women and men appear engaging in child feeding practices and agricultural activities alike, thus sending messages against fixed gender roles linked to nutrition and agricultural production. A similar approach is used across all communication channels including printed material, verbal and visual communication in events. The Food Guide for Peruvian Population was analyzed and revised by the team to adapt its recommendations to the local context of the project intervention areas. The dissemination material targeted beneficiary households and local stakeholders (health clinics, social protection programs, municipalities, and the Ministry of Agriculture). The dissemination materials developed include:

- **A flyer with key messages about nutrition and agricultural practices.** The flyer was distributed amongst beneficiary recipients of seeds of the biofortified potatoes (Annex 4).
- **The song and video: “Papas Puño de Hierro” (Iron Fist Potatoes).** Produced entirely by one member of the IIN team and a local singer. Both the song and the video have been broadcast by radio stations in the Districts of Curocos and Julcán by the partner Asociación Patataz and through the social networks by the Municipalities (Annex 5).
- **Nutritional-agronomic calendar 2021.** This calendar contains basic messages about good nutritional practices for infants as well as agronomic messages. It uses metaphors to facilitate the understanding of the messages for mothers and fathers with infants. The calendar was distributed to the intervention households by Asociación Patataz (Annex 6).
- **Guide on Good Nutritional Practices for infants.** This guide is an adaptation of the “Food Guide for Peruvian Population” targeted to health personnel to help them give nutritional counselling to mothers with infants adapted to the local context and the project intervention areas.

4.2.5. Surveys on the effects of COVID-19 health crisis and quarantine measures in Peru on livelihoods of potato farmers and food security

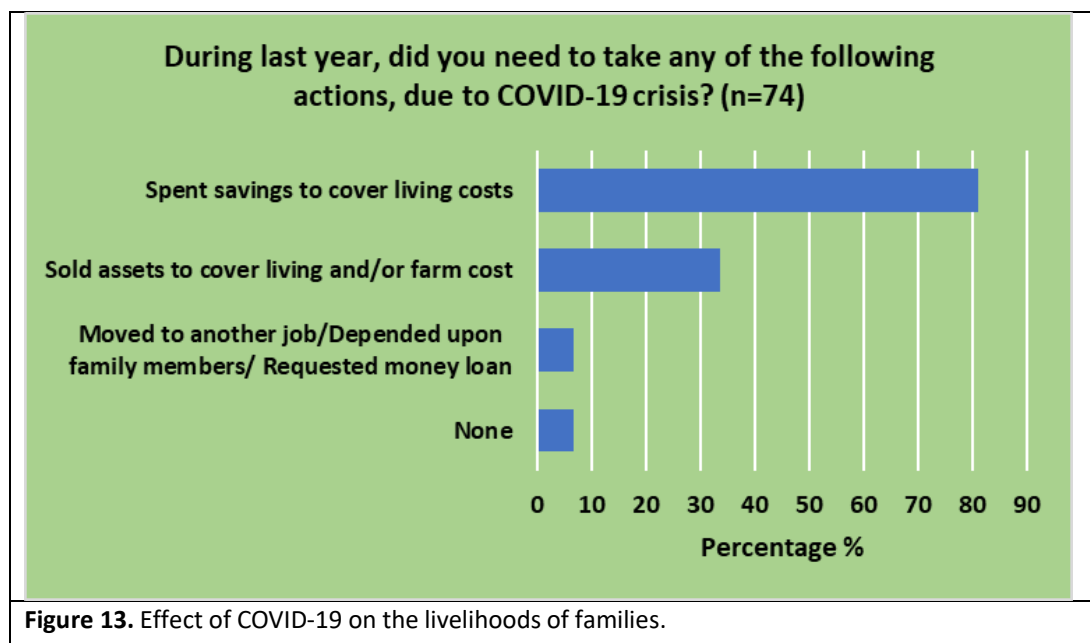
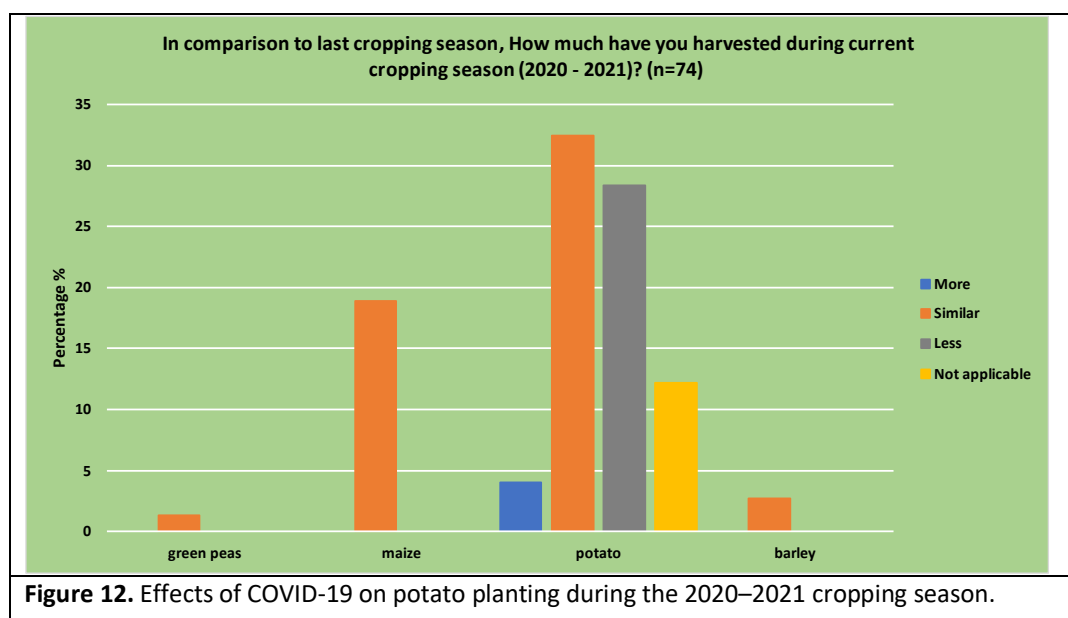
The COVID-19 pandemic affected the project design and intervention and there was a need to understand the implications of quarantine measures on the livelihoods of targeted households and on potato production, consumption and marketing in the intervention areas.

Survey 1: A first rapid survey of representative Andean potato producers in the target region was conducted from June to July 2020. The sample size included 214 women and men from households located in Andean communities from eight provinces and three departments (La Libertad, Junin, and Huancavelica). The survey covered four major domains: food security, labor availability, farm system resilience, and agricultural system connectivity. Together with the International Centre for Research in Agroforestry (ICRAF), who followed a similar approach for coffee, an article presenting the results of the survey was published in *Agricultural Systems* (Vargas et al., 2021, see reference list).

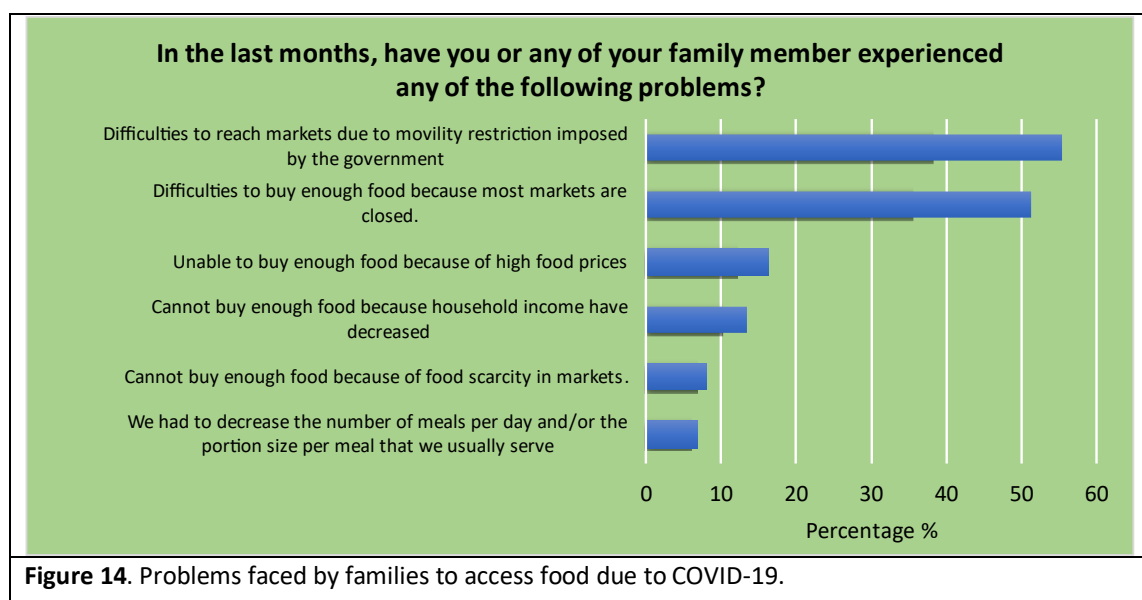
Summary of results: this study contrasts the short-term effects of the quarantine measures implemented to contain the COVID-19 disease on the production and commercialization strategies of potato and coffee producers in Peru. Potato farmers appeared more impacted by the shock due to disruptions in the commercialization channels leading to lower sales volumes and prices. At the short term, both potato and coffee farmers risk severe capital losses that are likely to affect the next agricultural season. Households also changed food consumption patterns. In some regions, households growing potatoes also stopped consuming some food items and increased consumption of staples, raising concerns from local health authorities about potential long-term negative effects for malnutrition, especially anemia, due to reduced consumption of animal-sourced foods. We believe the relatively small sample of the study does not prevent the generalization of the results. As such, this study is an indication that the COVID-19 health crisis in Peru is affecting the progress made towards meeting SDGs especially SDGs 1 (no poverty), 2 (zero hunger) and 3 (health and well-being).

Survey 2. A follow-up COVID-19 Impact Survey was implemented between August and September 2021 covering 74 families of the three provinces that participated in the 1st survey in 2020 in La Libertad Department only.

The first survey provided descriptive cases to understand the immediate effects of quarantine measures implemented to contain the COVID-19 disease on potato and coffee producers in rural Peru. Data showed that the restrictions had differential impacts on coffee and potato producers showing that potato farmers appeared more impacted by the shock due to disruptions in the commercialization channels, leading to lower sales volumes and prices concluding that in the future, they would risk severe capital losses that were likely to affect the next agricultural season. Around 50% of the 57 potato farmers interviewed planted fewer potatoes compared to the previous season, which could be explained by the reduction of income and the need to use part of their savings to cover their living costs which reduced the capacity to buy inputs such seed and fertilizers. In the second survey, the share of farmers reducing potato areas is lower (around 28%), and the number of farmers planting more is less than 5%. These results suggest that potato area has not recovered completely yet from the drop in the previous season when COVID-19 restrictions were hitting harder. Farmers continue to report spending savings and selling a large share of assets to cover expenses (Figures 12 and 13).



In the first survey, it was anticipated that COVID-19 could affect the household consumption patterns and affect the family's food security along with some concerns about long-term effects on the health and nutritional status of the households. Figure 14 presents some indicators on the problems faced by the households to access food responding to the need of the families which could have affected the nutrition quality and health of its members, especially small children.



The preliminary analysis of the second survey presents some information complementing the conclusions of the first survey on the effects of COVID-19 on the households' incomes and consumption patterns with an effect on the family's food security. It appears that potato farmers economically impacted by the shock due to disruptions in the commercialization channels faced financial challenges to invest in crop management and had to use part of their savings to cover their living costs.

4.3. SO3. Evaluate project intervention with participating institutions

The evaluation process of the project included several activities and was implemented in collaboration with IIN and Asociación Pataz, the main project partners.

4.3.1. KAP-Anemia endline survey and preliminary assessment of the project intervention

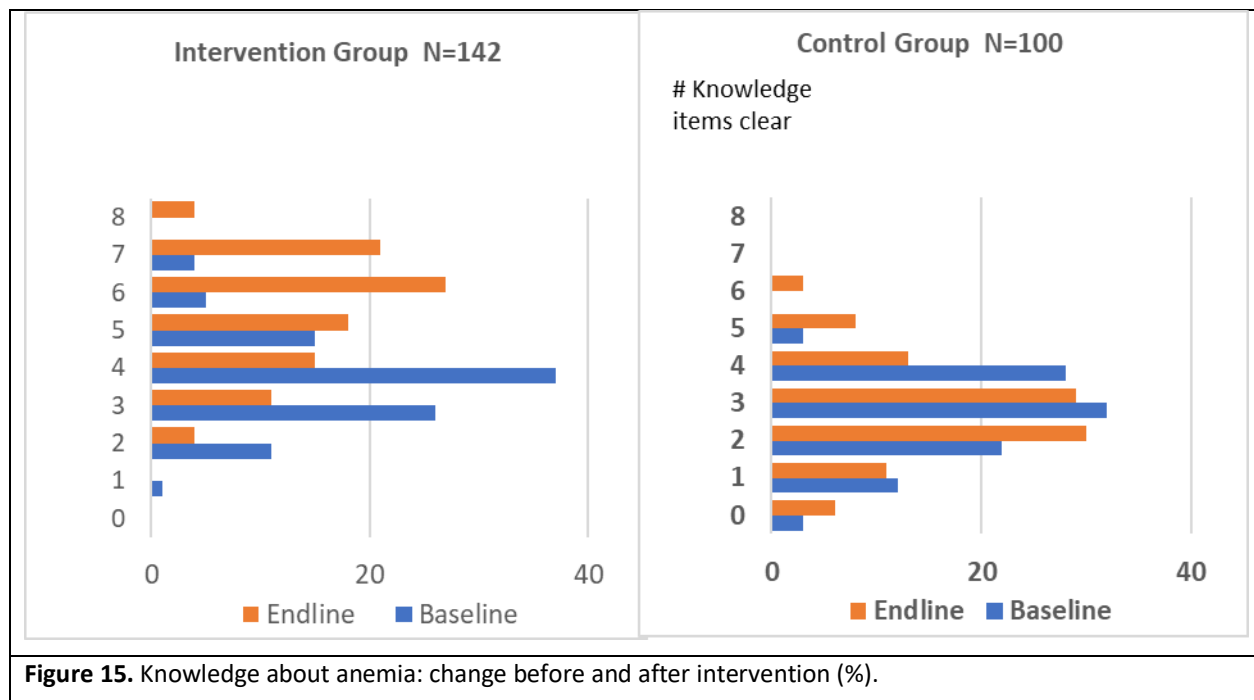
As in the baseline survey, the endline survey sample consisted of 242 parents/caregivers (142 = intervention group and 100 = control group) from the districts of Curgos, Julcan and Huamachuco in La Libertad region, who voluntarily agreed to participate in the study. The KAP-Anemia survey assessed changes between the intervention and control groups in the areas of knowledge, attitudes and practices.

Knowledge

By the end of the intervention, 97% of the control group and all the intervention group correctly recognized at least one sign of anemia. In contrast, only 8% of the intervention group, and none of the control group, managed to correctly identify the foods that prevent iron from being well absorbed. The intervention group mainly identified mate, tea and infusions as inhibitors of iron absorption. Many considered that junk food, sweets, soft drinks, rice and noodles, are the cause of poor absorption of iron, which is incorrect.

"How can anemia be prevented?" is the question indicating the largest difference between the two groups: only 2% answered correctly in the control group and 70% did so in the intervention group. Both groups showed an improvement of the knowledge about the signs of anemia. There was an increase in the control group (from 88 to 97%) who correctly recognized at least one sign of anemia without mentioning a wrong one, while in the intervention group the share goes from 99% to 100%. The number of participants in the control and intervention groups who correctly identify animal-source foods and legumes as iron-rich foods remained relatively high and constant. At the same time, both groups increased by about 20% the number participants who could identify foods that help to make better use of iron. The foods that were mentioned more often were citrus fruits, pineapple, carambola or star fruit (*Averrhoa carambola L.*) and passion fruit.

Overall, in both cases the knowledge increased, although in the intervention group the increase is larger (Figure 15).



Attitudes

The attitude towards the severity of anemia in children, according to the participants, changed in both groups at the end of the intervention. It went from zero people in the two groups considering it serious to 96% of the control group and 91% of the intervention group.

Table 7. Attitudes of mothers about anemia (%).

Attitudes	Intervention (n=142)		Control (n=100)	
	Base	End	Base	End
<i>How serious is anemia as a disease in children?</i>				
Not serious	86	0	58	0
Don't know	14	9	42	4
Serious	0	91	0	96

Also, the share of mothers considering the disease “not serious” was reduced to zero at the endline. In general, attitudes seem to have increased for both the intervention and control groups, suggesting that communication campaigns have reached both groups effectively.

Practices

Potato continued to be the most consumed food. The day before, 91% and 98% of children belonging to the control and intervention groups, respectively, had eaten it. The analysis of the nutritional practice for young children, in both districts, indicates the presence of low food diversity in the diet. The amount of food of animal origin consumed the previous day remained relatively constant and low before and after the intervention. Lentils, dry beans, liver and chicken continue to be the most consumed food after potatoes in the intervened group. The percentage of families consuming these foods was lower in the control group with only 3% of the children consuming broad beans the day before, while 20% in the intervention group did.

The 24-hour recall shows that, in the intervention group, the number of children under three years of age eating three or more animal source food items increased from 3% to 21%. Given the contradictory nature of some of the results, this deserves more attention and analysis (Table 8).

Table 8. Share of children < 3 eating animal-source foods (ASF) and vegetables, 24-hour recall.

Number of food items	ASF (%)				Vegetables (%)			
	Intervention (n=142)		Control (n=100)		Intervention (n=142)		Control (n=100)	
	Base	End	Base	End	Base	End	Base	End
0	15	18	52	36	0	0	0	1
1	70	79	39	58	34	32	40	45
2	54	24	9	6	81	78	56	49
3	3	10	0	0	24	25	4	4
4		7		0	3	6	0	1
5		2		0		1		0
6		1		0				
8		1		0				

Nutritional strategy

After the intervention, almost all the participants were taking their children to health clinics for checkups: 98% in the control group and 95% in the intervention group. Likewise, 95% of both groups receive supplementation with ferrous sulfate at the health post. There is a great difference between the intervention group and the control group. In the intervention group, 67% receive ferrous sulfate every 0 to 3 months and in the second, 50% receive it every 4 to 6 months. The statistical significance analysis of these results has not been conducted yet.

All families of the intervention group received written educational material on nutrition, compared to only 11% of the control group. Most of those in the intervention group found the contents of the materials good, understandable and useful to combat anemia and/or to have a healthy diet.

Most of those in the intervention group also mentioned having heard the song “Iron Fist Potatoes” in training sessions and through the radio or by WhatsApp. The song did not reach the control group.

Conclusions

Although the causes of anemia are not yet entirely clear to families and mothers, an improvement was observed in the intervention group, suggesting that the intervention did have an effect on knowledge, attitudes and practices of households. There is still room to clarify some ideas, since households seem to confuse anemia causes with the causes of overweight and obesity. In addition, an improvement in the identification of iron absorption inhibitors (*mate*, tea, infusions) is also observed, although the belief that foods causing overweight and obesity act as iron inhibitors also increased.

It was quite remarkable and encouraging that the study participants show a positive attitude towards how to reduce childhood anemia at the end of the intervention, improvements were found in knowledge, attitudes and practices in both groups (intervention and control), this improvement being greater in the intervention group in general. This seems to suggest that the communication campaign also did have a spillover effect in the control groups, something already observed in other ag-nutrition interventions.

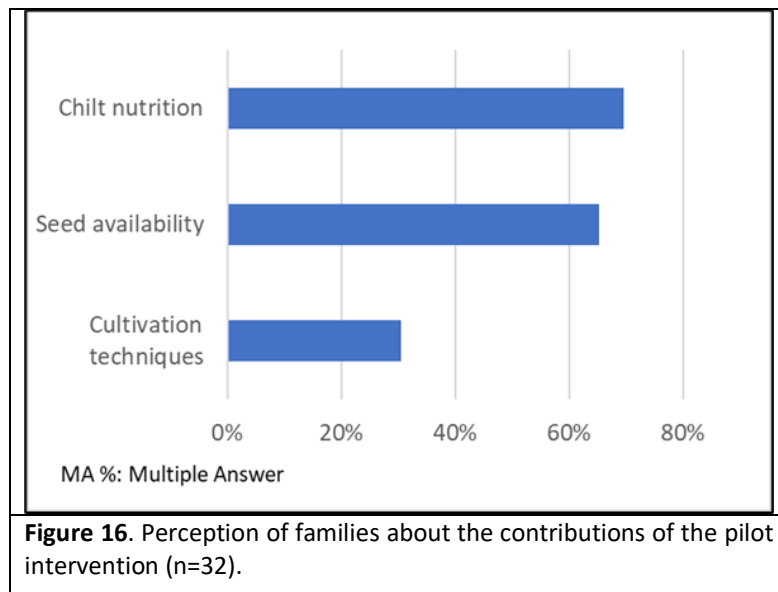
4.3.2. Qualitative evaluation of the effects of the project

Relevant experiences and perceptions about the project were collected in October 2021 through 18 interviews including 12 beneficiaries, three local authorities, and three staff from health centers. Another survey was implemented aiming at understanding the perception and preliminary intention to adopt biofortified potato clones and varieties with higher Fe content. This survey was conducted amongst 46 smallholder potato producing households randomly selected from the 142 households in the intervention area that had received biofortified clones and varieties. The survey was conducted between September and October 2021.

Other perceptions of households about the productive aspect of Iron Fist Potatoes (PPH) were already discussed in section 2.3.

Perceptions on culinary aspects. All parents (women and men) interviewed stated they had consumed the PPH together with their small children. They were served mostly boiled, either in pieces or in puree and their culinary qualities were well appreciated. A high percentage of families, about 80%, had a preference for the native Huevo de Indio variety, while one of the three biofortified clones was appreciated by around 50% of the parents/caregivers. This is somewhat expected, since the native variety was selected due to its high local demand, amongst other factors, while the new biofortified clones are new genetic materials without yet having established preferences.

Perceptions about the contributions of the pilot intervention. Around 70% of the parents made good comments regarding the contributions of the pilot intervention (Figure 16). They indicated it contributed to improving child nutrition, referring to the training given by the technical team of the project: *"With this project we have learned how to improve our children's diet, with the consumption of this iron-rich potato we can improve health."* They appreciated the voucher mechanisms for seed distribution and a smaller number of families liked the project contribution to improve crop management practices.



Most of the participants interviewed expressed motivation to continue planting the PPH mainly because of the knowledge acquired about their contribution to nutrition and the reduction of childhood anemia. About 70% of the participants considered that the training in nutrition together with the distribution of the PPH seeds were the most recognized contributions of the pilot intervention.

Most of the participants (94%) were interested in continuing to plant PPH varieties in the following agricultural season (2021/2022). Likewise, one in every four participants stated that they will distribute seeds to their close

contacts, 19% will share only the Huevo de Indio seeds, and 16% Huevo de Indio and the biofortified clones, thus contributing to the dissemination of seeds in their communities.

4.3.3. Monitoring, evaluation and learning (MEL) system

The monitoring, evaluation and learning (MEL) system was a fundamental component of the Zero Anemia project. Two of the three monitoring and evaluation instruments were related to KAP (baseline and endline surveys) about anemia. The third instrument was about monitoring the planting and use of new biofortified planting material. However, the COVID-19 emergency situation created a new context where learning about COVID-19 implications on agriculture and nutrition was key, not only to adapt the intervention but also to generate evidence for policy makers on how potato farmers were impacted by the emergency. Therefore, a new learning instrument was added to capture the adaptation due to the COVID-19 emergency, the challenges, and the opportunities. All data collected through these instruments have been published in the Dataverse system with full open access after a reasonable embargo period.

Databases

1. Databases about COVID-19 emergency status of potato producers in the Peruvian Andes.

Two representative household surveys to Andean potato producers were conducted from June to July 2020 (first survey) and from August to September 2021 (second survey). The 2020 COVID-19 survey had a sample size of 214 households located in Andean communities from eight provinces and three departments in the Peruvian Andes. For the 2021 COVID-19 survey, we purposively selected three provinces in Julcán, Pataz and Sanchez Carrión, just in La Libertad Department in Peru. Where we purposively selected 74 smallholder potato producing households that participated in the first COVID-19 survey. The survey covered the five major domains: COVID-19 knowledge, food security, labor availability, farm system resilience, and agricultural system connectivity. Additionally, in the 2020 survey, we interviewed key stakeholders to comment on the impact of COVID-19 on their sphere of influence between June and July 2020. The sample size includes 44 stakeholders located in Andean communities from eight provinces and three departments. The stakeholder survey covered four major domains: food security, labor availability, farm system resilience, and agricultural systems connectivity.

2. Databases about knowledge, attitude and practices changes about Anemia in intervention sites of the project: baseline and endline surveys.

These baseline and endline surveys were conducted 10–21 December 2020 (baseline) and 28 September–21 October 2021 (endline, after the intervention) to evaluate changes in knowledge, attitude and practices with respect to the actions taken to improve anemia reduction on children in selected communities. It is important to note that the units of analysis were households with children under five years old as targeted by the social protection programs. We purposely selected two provinces in Julcán, and Sanchez Carrión, in northern Peru. In each district, we also purposively selected 242 smallholder potato-producing households, 142 households in the intervention area of Sánchez Carrión, and 100 households in the control group in Julcán. The survey instrument presented several questions divided in the following sections: (1) informed consent; (A) socioeconomic information from both parents and children; (B) knowledge, attitude and practices corresponding to anemia; and (C) crop production aspects.

3. Database about monitoring of biofortified potato adoption of potato producers in intervention sites of the project.

This survey aims to measure perception and preliminary adoption of biofortified potato clones and varieties with iron. The survey corresponded to the following sections: (1) general information; (2) informed consent; (3) potato planting information; (4) potato harvesting information; (5) biofortified seed distribution; (6) biofortified potato consumption; and (7) general comments. We purposely selected three provinces in Sanchez Carrión, in northern Peru. We randomly selected 46 smallholder potato producing households from the 142 households in the intervention area of Sánchez Carrión that received biofortified clones and varieties. The survey was conducted between September and October 2021.

The list of all databases produced by the project are available and fully open access through CIP's Dataverse system (Annex 9).

4.3.4. Scaling potential of the project innovations (scaling workshop)

To evaluate the scaling potential of innovations developed by the Zero Anemia project, the concepts of the "Scaling Readiness" approach developed by the CGIAR Research Program on Roots, Tubers and Bananas (RTB)⁴ were adapted. The empirical approach was applied in a workshop organized on 15 December 2021 with the participation of 18 project team members including CIP project team, strategic partners team members (IIN and Asociacion Patataz) and members of CIP Programs and Divisions that have been supporting the project.

The project promoted a series of innovations, including: biofortified potato clones, a model for the supply and use of quality seed, communication tools (guides, booklets, songs and others) on nutritional education, and schemes for linking agriculture and nutrition with social protection programs in local contexts. This model was tested in the Andean region, for the specific case of combating anemia in potato producing households. The scaling analysis focused on three major innovations identified by the project team members:

1. Institutional coordination with Municipalities, Health Centers and Social Protection Programs.

Institutional coordination with Municipalities, Health Posts and Social Protection Programs for identification, monitoring of the beneficiary population and inclusion of the innovation strategy in local development plans. It also included cross-messaging to enhance access for women and men to information, bridging the traditional gender norms, roles and communication channels.

2. Nutritional education strategy and materials.

Different types of nutritional education materials adapted to the intervention area have been produced:

1. Agricultural/nutritional calendar supporting training on agricultural practices to enhance women's access to agricultural information through alternative communication channels.
2. Nutrition guidelines adapted to locally available foods.
3. Potato song "Iron Fist".
4. "Iron Fist" potato dish contests.
5. Demonstration sessions to validate messages developed by national institutions in the local context through formative research, and provide simple messages.
6. Participatory nutrition practices with health personnel.

3. Biofortified potato varieties.

Potato varieties and advanced clones with high iron content, adapted to the project's areas of influence.

This was considered an innovation package in full, with complementary innovations including:

- A seed distribution system through vouchers for new varieties;
- A seed production system for biofortified varieties;
- A multi-institutional platform to produce and distribute the seed of biofortified varieties supporting training on nutrition to enhance men's access to nutritional information through alternative communication channels.

The innovations were assessed on three criteria: degree of development of the innovation, level of use, and actions and collaborations required to further promote the scaling of the innovation.

⁴ Sartas, Murat; Schut, Marc; Schagen, B. van; Thiele, G.; Proietti, C.; Leeuwis, C. 2020. Scaling readiness: Concepts, practices, and implementation. International Potato Center on behalf of RTB. ISBN 978-92-9060-532-4. 217 p.

➤ Degree of development of innovations

Through participatory analysis, the degree of development or maturity of the selected innovations were assessed:

Degree of development*				
Innovations/position on the scale	1	2	3	4
1. Institutional coordination with Municipalities, Health Posts and Social Protection Programs			X	
2. Nutritional education strategy and materials		Components 1;2; 6	Components 3;4;5	
3. Biofortified potato varieties	X			

***Scale:** 1: Proof of concept or hypothesis; 2: Validation and adjustment with users in the context of their development; 3: Validation and adjustment with users in contexts other than their development and 4: Documented evidence of results, effects and benefits in validation contexts.

- 1. The institutional coordination** included coordination with Social Protection Programs, Health Posts, Municipalities and Agrarian Agencies in the territories where the project intervened. Asociación Pataz is beginning to incorporate some of the elements of the institutional arrangements, talks and training with health personnel and nutritionists in broader areas of their intervention strategy in the area.
- 2. The nutritional education strategy.** The degree of development was linked to the different components, the Iron Fist potato song, the Iron Fist potato dish competitions and the demonstration sessions scored a 3 because they were validated in a broader context while the agricultural/nutritional calendar, nutrition guides adapted to locally available foods and participatory practices with health personnel were scored at the level 2.
- 3. Biofortified potato varieties.** These varieties were evaluated with partners and beneficiaries in the project areas but to be validated and used more widely they require, as indicated in the description of the innovation, other complementary innovations including institutional arrangements and coordination with specialized entities, such as seed production and specialized multipliers. The formal variety release process will start in 2022 with the application to register a new variety, in coordination with the National Agriculture Innovation Institute (INIA). Release of the new variety is expected for 2023. Therefore, as the biofortified advanced clones are not yet formal released varieties, it was a further motivation to score this innovation as a 1.

➤ Level of use of the innovations

The level of use of the innovations scored 1, which indicates that they were known and used by the developers and their partners in the framework and context of the project and by the project beneficiaries (men and women). In the case of institutional coordination, a scale 3 was reached which indicates that some of the arrangements to foster coordination between Social Protections Programs, Health, Municipalities and Agrarian Agencies are used on a larger scale (larger target group and greater coverage) by actors and users (men and women) other than those involved on their development.

The combination of both criteria, the degree of development and the level of use, defines the *scalability* of the innovations. To reach a higher level of scalability, different complementary innovations, institutional arrangements and actions involving public and private partners are required.

➤ Actions and collaborations required to further promote the scaling of the innovations

Institutional coordination

It would be useful to map the main actors in the territory and in a broader context to identify potential allies for scaling and the required coordination. It would subsequently be necessary to strengthen the capacities of local

actors and potential partners through alliances and coordination with other organizations present in the territories and with a wider geographical coverage such as the Zero Hunger initiative of MIDIS. Also, it would help to develop communication mechanisms with simple messages that allow innovations to be transmitted easily and made known.

Nutritional education strategy

To promote this innovation, it is necessary to include the education sector in nutritional training and invest in creative communication and advocacy campaigns. It is also important to implement formative research to locally contextualize the materials to be used with allies and beneficiaries. Gender equality is still a big challenge to be addressed as many local actors, particularly from the public sector, do not yet perceive the need to include men in capacity building on nutrition, feeding and caregiving practices.

Biofortified potato varieties

Strengthen the efficient multiplication of seed with specialized entities together with training for seed producers. Promote the use of vouchers for the distribution of seeds through health clinics. Reinforce the capacities of the producers with applied technologies that guarantee good productivity and multiplication of the seeds of the biofortified varieties. Promote the qualities of the biofortified potato to reduce anemia in the framework of a nutritional education program.

➤ Conclusions about the scaling analysis

Successful adoption and scaling with technological and institutional innovations depend to a large extent on the institutional context and accessibility of complementary innovations (training, knowledge, policies and services). For instance, in order to scale new biofortified varieties, interventions should develop strategies to enhance awareness of the qualities of the biofortified potato to reduce anemia and their productivity, build alliances and coordinate with relevant public and private actors in the seed system and provide training on farm management practices. It should also support new policies with local authorities and promote institutional arrangements and actions involving public and private partners.

Achieving scaling requires a long-term effort that is favored by the presence of solid local organizations such as the Asociacion Pataz with development mandates, successful experiences, access to independent financial sources and appropriate staff capacity. Through the capacity built by pilot interventions like the Zero Anemia project, these organizations can promote the use of innovations and the integrated approach of agriculture and nutrition. Those are the organizations responsible to continue the scaling process after the completion of the pilot interventions.

4.4. SO4. Generate policy recommendations for the implementation of the scaling framework in Peru

The project was coordinated with national and local authorities, health agencies and MIDIS to ensure buy-in of project results and to inform communities on COVID-19 prevention, emphasizing messages to reinforce the nutritional dimensions.

At the local level, Asociacion Pataz continued to participate in the Curgos District Health Council, chaired by the District Mayor and made up of local institutions from the health, agriculture, and education sector and organizations, such as the “Glass of Milk Committee”. During 2020, the Council could only hold three sessions given the restrictions due to the health situation. In Julcan, the Health Council did not meet in 2020.

High turnover of authorities at the national level due to political instability and at local level due to COVID-19 restrictions affected face-to-face policy advocacy and most activities have been conducted remotely. The project implemented a series of events with stakeholders and authorities at the regional and national levels to share results and promote and position the intervention strategy as a policy discussion.

Advocacy actions organized

- At the national level, the preliminary results of the **survey held to assess the effect of the COVID-19 crisis and quarantine measures** on the livelihoods of potato farmers in Peru were discussed during a policy seminar organized by the Interamerican Institute for Cooperation in Agriculture (IICA), the Ministry of Agricultural Development and Irrigation (MIDAGRI) of Peru and CIP (full seminar available at: <https://bit.ly/2PKZhXa>).
- **Workshop/webinar on the approach of the Zero Anemia Project about Innovations in Agriculture and Nutrition, Contributions to the Reduction of Anemia and Chronic Child Malnutrition**
The [workshop](#) was organized on 9 September with 77 participants from 29 institutions to share the experience of the Zero Anemia Project in La Libertad Region and its approach that combines interventions in agriculture and nutrition in coordination with social protection programs to reduce anemia and chronic child malnutrition. Another objective was to create a coordination space involving similar actions for scaling (learning and replication) with different public and private actors interested in the approach and interventions.
- **Participation in the Permanent Seminar on Agrarian Research (SEPIA) conference held in Puerto Maldonado (December 2021).**
The Permanent Seminar on Agricultural Research (SEPIA) is a space that promotes research and debate on rural, agrarian and environmental issues from a multidisciplinary perspective. The seminar SEPIA XIX was held in Puerto Maldonado on 6–10 December 2021. The project participated in an international workshop related to Theme III of the Conference on Agrifood Systems and the Production of Family Farming. A presentation was made on “Food and production systems in the Andean zone: agriculture, nutrition and income generation” based on an article to be published in the proceedings of the Seminar (Ordinola et al. 2021). The project team facilitated the organization of an international roundtable: “Agrifood systems, family farming and innovation” with key international experts as panelists:
 - Máximo Torero (FAO): Tradeoffs and synergies when we talk about agri-food systems.
 - Jan Low (CIP): Innovation in agriculture-nutrition: the case of sweetpotato in Africa
 - Mark Lundy (Alliance Bioversity-CIAT): Research agendas for a city-region using a food systems approach.
- **Participation in the Peru Con Ciencia Fair-CONCYTEC**, organized from 8 to 12 November 2021 with the participation of more than 30 institutions, including universities, public research institutes and technological and innovative companies, as well as international institutions as special guests. A presentation was made on ["Biofortified potatoes to face anemia"](#) illustrating the CIP-IIN-AP experience and local, regional and national allies, to promote the cooperation of CIP genetic improvement research program with development-oriented interventions and national organizations to reduce anemia in Peru.
- **Temporary Intervention Zero Hunger-MIDIS.** Participation of the Zero Anemia team in the platform for La Libertad Region. The Temporary Intervention "Zero Hunger" was created on 20 January 2021 and is coordinated by MIDIS. Through this platform, Asociacion Pataz and CIP had the opportunity to participate in workshops organized by the Regional Center for Strategic Planning of the Regional Government of La Libertad (CERPLAN - GORELL), with the participation of multiple local, regional and national institutions. It integrates a set of actions derived from the project in the "Agenda for competitiveness and territorial development", and the "Agrarian Agenda" of the provinces of Pataz and Sánchez Carrión, La Libertad Region, such as: i) generate solid links between agriculture and nutrition with the application of the model for the distribution of potato seeds and other crops rich in micronutrients in alliance with health micro-networks and Social Protection Programs; ii) demonstration sessions with foods rich in iron for mothers; and iii) spot radio broadcasts on the importance of consuming iron-rich foods with language from the area and inclusive of gender. Two actions were also included in the "Agrarian Agenda" to improve extension and agricultural and livestock productivity.

After these different events several institutions expressed interest in the Zero Anemia project approach promoting the link between agricultural production systems and food systems to improve food security for the most vulnerable rural families. A new project to strengthen the Agricultural Innovation System led by CIP together with the Ministry of Agriculture (MIDAGRI) and funded through the Technical Secretariat for Cooperation with the CGIAR (STC-CGIAR, Government of Peru) includes the project area and the intervention approach as pilot innovations.

V. Project outputs and dissemination

Several outputs and communication materials were developed by the project with partners. To generate communication materials, the results of the formative research were used to adapt the messages according to consumption patterns and local culture. Metaphors were used for agronomic and nutritional aspects that facilitate the understanding of the messages. So far, two scientific articles and one conference paper have been published with project results.

5.1. Information sharing and dissemination

- Flier with information about the agronomic and nutritional characteristics of the biofortified potato clones and native potato varieties (Annex 3).
- Flier with key messages about nutrition and agricultural practices (Annex 4).
- **The song and video: *Papas Puño de Hierro* (Iron Fist Potatoes).** Produced entirely by one member of the IIN team and a local singer. Currently being broadcasted by radio stations in the Districts of Curo y Julcán (Annex 5).
<https://cgiaar.sharepoint.com/:u:/s/CIP/ddqr/sns/EWxk42jF5bROoAyDKaSX4pcBxtddyHoQFLNxzoqH3Lfaqw?e=r2zpIO>
- Educational Document: Nutritional Agricultural Calendar (Annex 6).
- Journal article: **COVID 19 Health crisis and quarantine measures in Peru: Effects on livelihoods of potato farmers, *Agricultural Systems*** <https://doi.org/10.1016/j.agsy.2020.103033>
- **Carrasco M., Bartolini R., Pinedo F., Fonseca C. 2021. Recomendaciones de alimentación para niñas y niños menores de 2 años de edad.** Centro Internacional de la Papa: Lima, Perú. (Annex 8)
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Future publications planned:

- CIP institutional publication with project approach, achievements and lessons learned (end of 2022).
- Scientific article on the approach used to enhance the link between agricultural production and food systems to improve food security for the most vulnerable rural families, with more rigorous analysis of the data (expected to be ready for submission at the end of 2022).
- SEPIA Book: Sistemas alimentarios y productivos en la zona andina: agricultura, nutrición y generación de ingresos (2022).

- Blogs and policy brief on “Findings and lessons learnt from gender responsive scaling of agricultural innovations and social protection programs” (Q3 2022).

5.2. Knowledge creation, new technologies, new methodologies

- The project team, in collaboration with the CIP breeding program, contributed to the evaluation of eight biofortified potato clones for the second consecutive year, with the purpose of releasing one or two varieties for the northern highlands of Peru.
- The methodology of formative research was adapted by IIN and implemented with Asociacion Pataz in the project intervention areas.
- Adaptation and application of the FAO KAP-Anemia survey for the case of potato farmers in the high Andes of Peru.
- Adaptation of the RTB Scaling Readiness methodology.

5.3. Capacity building

- Good Nutritional Practices, Guide for good nutritional practices for infants, see above under: “Carrasco M., Bartolini R., Pinedo F., Fonseca C. (2021). Recomendaciones de alimentación para niñas y niños menores de 2 años de edad. Centro Internacional de la Papa: Lima, Perú
- Nutritional-Agronomic Calendar 2021. This calendar contains basic messages about good nutritional practices for infants as well as messages about agronomic aspects. It uses metaphors to facilitate the understanding of the messages to mothers and fathers with infants (Annex 6).
- The Asociacion Pataz provided training and technical assistance to 80 beneficiary families on key crop issues: Seed production techniques and integrated pest management with the support of the agrarian agencies of Curo y Julcán. The Association Pataz contributed to strengthen the capacities of 200 mothers, fathers of children under 36 months of age, in healthy eating, anemia prevention, exclusive breastfeeding, complementary feeding and demonstration sessions of foods with high iron content.
- Training activities for mothers of young children were implemented about Good Nutritional Practices through physical and virtual training sessions involving nine health agents, 32 community agents and 78 mothers of families in person (respecting precautions against COVID-19 involving small groups of participants) and 49 in virtual form.

5.4. Institutional capacity

- **Potato seed voucher** developed with local partners especially health centers (Annex 1 and 2).
- **Guide of Good Nutritional Practices for infants.** This guide is targeted to health personnel to help them to give nutritional counselling to parents with infants (Annex 8).
- In January 2020, IIN trained key project team members from Asociacion Pataz and CIP on nutritional concepts and methodologies for formative research, to prepare them to go to the field with a basic understanding of the intervention approach. The capacity was created and Asociacion Pataz has retained these key personnel who are working in other projects and applying the knowledge and lesson learned.

5.5. Impact of COVID-19 on the project activities

Immediately after the quarantine due to COVID-19 was declared in Peru on 15 March, and as part of an institutional strategy, CIP prepared a contingency plan identifying critical activities of the project, potential impacts, and proposed solutions. This contingency plan covered activities for a 90-day period until mid-June 2020 and had to be assessed once the quarantine measures would be lifted and the Government’s rules for reopening were known.

CIP and partners' staff health and safety. All travel (domestic and international, inbound, and outbound) were suspended for CIP staff following institutional regulations. IIN had to cancel surveys for the formative evaluation because staff had to return home. The project team coordinated with Asociacion Pataz who followed its own institutional protocols for field work. Since then, all communications between project staff members and partners were conducted remotely, with bi-weekly scheduled meetings and sharing of notes and action points from each meeting.

Seeds of the advanced potato clones and varieties with high micronutrient levels in the demonstration and multiplication plots. CIP established an institutional committee to closely follow up with Asociacion Pataz and coordinate with communities and farmers the implementation of evaluation trials and the harvesting and storage processes.

Other field activities. All other field activities, as well as face-to-face contacts with local and regional stakeholders, social protection programs, health clinics, and others were initially cancelled. A protocol was developed to then conduct field activities ensuring the health and safety of project personnel and project beneficiary households (Annex 7).

Design of the intervention. The project had to adjust the design of the intervention organizing remote interviews, virtual workshops and phone interactions (e.g., field surveys, household visits, etc.). These adjustments represented a challenge given that nutritional education, for example, needed properly counseling and follow up.

The formative research was informed the nutritional education component of the intervention. The primary data collection was suspended while the IIN staff member was in the field. IIN has reported that they had enough information to design the component, complemented with secondary information and expert opinion sought by phone interviews. Contacts were made with social protection programs in the intervention area by phone calls.

As the implementation of the project was slowed down due to the COVID-19 situation and some activities had to be redirected for the following season, there was a need to adjust the budget and ask for approval from IDRC. At the beginning of 2021, the health situation in Peru was still critical, with no signs of major improvements probably for the rest of the year. The full impact of the crisis was under assessment to determine adjustments to the workplan and modalities under which the different activities could be implemented in this final year.

Asociacion Pataz, to support field activities, had to adapt to a new working modality and adjust the capacity building strategies for beneficiaries. This was initially virtual, both in the agricultural area and in the nutrition area, due to the restrictions that were placed on holding meetings, health campaigns and training workshops. For field activities, staff of the Association worked with small groups of farmers who participated in the planting and in the harvest of biofortified potato clones. During 2021, the Association gradually resumed in person activities with small groups of participants for training of mothers, pregnant women and farmers respecting biosecurity measures. The restrictions on mobility generated an additional layer of complication that limited the participation of both women and men in activities. Therefore, most capacity building was provided to the main caregivers, in this case mothers.

In 2021, there was concern about the challenge to implement the final surveys on nutritional knowledge and practices of beneficiaries in the target regions, mainly due to time constraints and mobility restrictions. The team anticipated that more time would be needed to collect and interpret the data. It was agreed that the project would benefit from having additional time beyond the current work completion date of 31 August 2021 to overcome the delays and to finalize the preparation of the expected outputs and results of the project with the required quality standards. This extension until the end of 2021 was approved by IDRC.

VI. Impacts

The challenges generated by the health crisis due to COVID-19 in the Peruvian high Andean agri-food systems show the high vulnerability of small producers who could not access markets and sell their products in 2020. Since they did not have alternative market circuits to their natural routes, their incomes were affected almost immediately. Despite these problems, family farming, which produces most of the food for domestic consumption in rural areas of Peru, has contributed to partially cope with the context of the pandemic and its effects on food supply and demand. In addition, high Andean agriculture also includes diversified agricultural activities that help guarantee the local supply of food, the sustainability of the environment and the conservation of biodiversity. In this context, potato production plays an important role because it represents the basis of the diet of rural populations while also being a source of income, thus contributing to the resilience of the agrifood systems of the high Andean areas of the country.

During 2020 and 2021, the impact of COVID-19, on the project activities and on the communities where the project operated was critical and affected the field activities to be implemented with the strategic partners (Institute of Nutritional Research - IIN and Asociacion Pataz). Despite these challenges, the project adapted its strategies and was able to implement activities responding specific objectives of the project.

The project developed a conceptual framework for scaling agriculture and nutrition interventions in a sustainable way by linking with social protection programs and other local partners. The strategy consisted in promoting an innovation package, including technical and institutional innovations, around improved nutrition through agriculture including nutrition and health education, farming practices, potato seed systems, and advocacy for cross-sectoral integration. The model was implemented and tested through a pilot intervention in the areas of intervention in Curgos and Julcan in coordination with social protection programs and other local actors. The pilot intervention allowed 142 families with children under 36 months of age, direct beneficiaries of the project, to improve their knowledge about anemia and for most of them to understand some measures to reduce it. Promoting nutritional education in an interdisciplinary and intersectoral manner, with simple and key messages using gender-inclusive language focusing on parents in general but adapted to local culture by respecting the traditional role of mothers and emphasizing the importance of the active participation of fathers. This approach was important to improve knowledge and attitudes of parents and caregivers in general towards preventing anemia. The messages promoted by the project included the consumption of potato varieties with higher levels of iron, combined with a diverse diet. The families identified the importance of having more nutritious potato varieties and were motivated to continue planting the new varieties received mainly because of their contribution to nutrition and the reduction of childhood anemia. Incorporation of potatoes with a high iron content has thus been a new technology that passed from the observation stage to a stage of testing and potential adoption.

Asociacion Pataz contributed to strengthen the capacities of 200 mothers and fathers of children under 36 months of age, in healthy eating habits, anemia prevention, exclusive breastfeeding, complementary feeding and demonstration sessions of foods with high iron content to prevent childhood anemia in the districts of Curgos and Julcán. The project formulated and applied strategies for the distribution of the selected potato varieties using the voucher system which was implemented in collaboration with municipalities, health centers and social protection programs committed to reducing anemia. The coordination was more efficient in Curgos with Municipalities than in the Julcan district where local authorities were less interested by the project activities.

A communicational and educational strategy was implemented to complement the comprehensive agricultural and nutrition intervention, sharing messages based on the agricultural background of the households and aimed at tackling nutritional issues. The project has produced several educational materials following the findings and recommendations of the formative research and promoting the use of good agricultural practices including the use of biofortified potato varieties. The dissemination material has targeted beneficiary households and local stakeholders (health centers, social protection programs, municipalities, and the Ministry of Agriculture).

Parents of families received the greatest amount of information and were involved in different actions of this project. Through them, all caregivers were informed and encouraged to participate. Through their participation, the children have also been exposed to the communication materials and activities of the project.

The project strengthened the coordination with the breeding program of CIP, allowing us to enhance the collaboration with Asociacion Pataz and farmers' families to evaluate the eight potato biofortified advanced clones through participatory varietal selection with beneficiary families and multiply seed for subsequent years. Seed of the commercial native potato variety Huevo de Indio and of three selected biofortified clones were distributed to the intervened families to assess them in their own fields. This variety selection effort, developed through the project, is contributing to the future release of more nutritious potato varieties targeted for the northern region of Peru.

Institutional innovations were enhanced through the participation of the Asociacion Pataz team in coordination platforms such as the Zero Hunger initiative of the Province of Sánchez Carrión, organized by the Ministry of Social Inclusion (MIDIS) and Local Articulated Instance (IAL) involving different social actors to inform on key messages about nutrition and agricultural practices.

To evaluate the scaling potential of innovations developed with the Zero Anemia project, we applied the concept of Scaling Readiness with the CIP project team and the strategic partners. The scaling analysis concentrated on three main innovations: institutional coordination with Municipalities, Health Posts and Social Protection Programs; nutrition education strategy and materials; and biofortified potato varieties. The short duration of the pilot intervention has allowed the project to show that this agricultural-nutritional strategy can be introduced in the fight against anemia in rural populations of La Libertad region; but it is not enough to consolidate the sustained adoption of the change and its scaling.

Achieving scaling and project sustainability requires a long-term effort that goes beyond the implementation of a project and is favored by the presence of solid organizations such as the Asociacion Pataz. With its development mandates, successful experience, links with financing sources and key staff, they will continue to promote the use of innovations and the articulation approach of agriculture and nutrition focused by the project. Asociacion Pataz has indicated its interest to use the project model and materials in its future interventions.

The challenges created by the COVID-19 health crisis were critical and affected the field activities of the project. Despite these challenges, the commitment of CIP and strategic partners remained very strong and enabled the completion of most project deliverables responding to specific objectives.

VII. Recommendations and lessons learned

The project team benefitted from the direct interest and close collaboration with the IDRC Project Officer, who was available at all times for meetings and discussions and also participated remotely in some activities of the project. IDRC management was also prompt and flexible to respond to CIP queries, for example about budget reallocation and no-cost extension requests. This really enabled the project not only to adapt quickly and effectively to the challenges due to the COVID-19 emergency situation and the restrictions to field visits, but also to adjust objectives and approaches while the donor's knowledge about project opportunities increased. We commend the IDRC commitment, approach and flexibility and encourage the continuation of this approach in the future.

Given the relative short duration (34 months) and medium scale budget of the project, project objectives may have been too ambitious in the proposal design, particularly regarding the scaling of new innovations that were still under development, such as biofortified potato varieties. This is true even for a pilot research project testing complex approaches to innovation. Therefore, the actual impact and scaling of the innovations is currently limited to beneficiary families only. We responded during the proposal design phase to donor demands about the scope of the project. A more rigorous and transparent approach to determine feasibility of the project objectives may have helped to align better expectations with potential outcomes.

The policy advocacy component of the project was intense during the last six months of the project, once deliverables and innovation packages were at an acceptable stage of development. However, actual incidence in policy measures at the local level needs more time, and there are concerns about the sustainability of some progress made given current high political turn over in Peru. As such, direct impact was achieved only in some beneficiaries at the local level, and scaling impact to the larger district area, for example, is limited.

The COVID-19 emergency restricted visits and close monitoring of project activities in the field. Strong partnerships at the local level, such as the one developed with Asociacion Patataz, are required under these circumstances and are becoming the norm. Visits of the project officer were also restricted and prevented the project from forming a larger and much deeper interaction. We would appreciate the opportunity to make complementary presentations of project approach and results to IDRC in alternative venues, in order to increase shared learning and identify potential new opportunities and the way forward.

Finally, as a research and development project, data has been collected and partially analyzed, with still several opportunities for more rigorous analysis aiming at scientific outputs. Production of scientific articles takes longer than the limited duration of the project and requires additional time and resources to capitalize on the potential scientific impacts of the project.

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IX. Annexes

Annex 1. Potato seed voucher.

SOMOS LAS PAPAS PUÑO DE HIERRO

Junto a ti contra la ANEMIA

Cupón Nro. _____

Nombre del centro poblado: _____

Nombre del beneficiario: _____

Cantidad de semillas: _____

Sanos y fuertes sembrando para el futuro

Logos: CIP, INIA, CGAR, etc.

Annex 2. Farmer receiving potato seed in Curgos.



Annex 3. Flyer with information about characteristics of biofortified potato clones and native potato varieties.

SOMOS LAS PAPAS PUÑO DE HIERRO

Junto a ti contra la ANEMIA

PUÑO DE HIERRO A (BIOT - 721.245)

- Color de piel: Marrón
- Profundidad de ojos: Profundo
- Forma: Redondo
- Respuesta a la racha: Moderadamente resistente
- Rendimiento promedio (t/ha): 15
- Periodo de cultivo: 140 días
- Textura: Moderadamente harinoso
- Sabor: Agradable

PUÑO DE HIERRO B (BIOT - 725.047)

- Color de piel: Rojo-Morado
- Profundidad de ojos: Medio
- Forma: Oblongo
- Respuesta a la racha: Muy resistente
- Rendimiento promedio (t/ha): 16
- Periodo de cultivo: 140 días
- Textura: Moderadamente harinoso
- Sabor: Agradable

PUÑO DE HIERRO C (BIOT - 721.074)

- Color de piel: Marrón
- Profundidad de ojos: Profundo
- Forma: Redondo
- Respuesta a la racha: Resistente
- Respuesta al virus Y (PVY): Resistente
- Rendimiento promedio (t/ha): 15
- Periodo de cultivo: 140 días
- Textura: Moderadamente harinoso
- Sabor: Agradable

Las papas Puño de Hierro contienen 50% más de hierro que la papa Tunga y te ayudan a combatir la anemia.

Logos: USAID, CIP, INIA, CGAR, etc.

Somos las PAPAS NATIVAS de la zona

Con buen contenido de hierro y alta demanda en el mercado

BRETAÑA

- Color de piel: Marrón y mancha roja
- Profundidad de ojos: Superficial
- Forma: Alargado
- Respuesta a la racha: Susceptible
- Rendimiento promedio (t/ha): 20
- Periodo de cultivo: 150 días
- Textura: Harinoso
- Sabor: Muy agradable

HUEVO DE INDIO

- Color de piel: Marrón
- Profundidad de ojos: Superficial
- Forma: Oblongo alargado
- Respuesta a la racha: Resistente
- Rendimiento promedio (t/ha): 22
- Periodo de cultivo: 150 días
- Textura: Harinoso
- Sabor: Agradable

Contratista: Asociación Patate

Sanos y fuertes sembrando para el futuro

Annex 4. Flyer with key messages about nutrition and agricultural practices.



Annex 5. Song and video: *Papas Puño de Hierro* (Iron Fist Potatoes)

#ANEMIA CERO

SOMOS LAS PAPAS PUÑO DE HIERRO

Junto a ti contra la ANEMIA

PUÑO DE HIERRO A

PUÑO DE HIERRO B

PUÑO DE HIERRO C

Investigación Agraria AP

PROTEGETE

PAPAS Kenty José "PUÑO DE HIERRO"

Logos for USAID, CIP, COGAP, HarvestPlus, IDRC CRDI, iIN, and PODEROSA are at the bottom.

Link to the song: *Papas Puño de Hierro* (Iron Fist Potatoes)

<https://cgiaar.sharepoint.com/:u:/s/CIP/ddgr/sns/EWxk42jF5bROoAyDKaSX4pcBxttdyHoQFLNxzoqH3Lfaqw?e=r2zp1O>

Link to video to the song put in Youtube: *Papas Puño de Hierro* (Iron Fist Potatoes)

https://cgiaar.sharepoint.com/:v:/s/CIP/ddgr/sns/EaUhhV9sfH5GuZkntqWw_cBEFYWtEr03HAsaJhqp2lPtW?e=G0s25I

Annex 6. Educational document: nutritional & agricultural calendar.

Calendario **2021**

SOMOS LAS PAPAS PUÑO DE HIERRO

Junto a ti contra la ANEMIA

Logos of partner organizations: IDRC, CIDA, USAID, iin, and others.

ENERO 2021

Durante el embarazo hay que alimentar bien a la madre y al bebé. El hierro es fundamental para la formación de la sangre, músculos, hueso y el cerebro del bebé.

Hijito, hijita quiero que vengas a este mundo fuerte y sano, por eso como a diario hígado, pescado o huevo, acompañado siempre con papas puño de hierro.

Guiso de habas verdes con sangrecita más papa sancochada, acompañar con frutas: jugo de naranja.

Me pongo a sembrar con mi esposa las papas puño de hierro, porque en el futuro de mis hijos e hijas tenemos que pensar.

ENERO 2021

Dom	Lun	Mar	Mie	Jue	Vie	Sab
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SOMOS LAS PAPAS PUÑO DE HIERRO

Junto a ti contra la ANEMIA

Link to the document (in Spanish):

<https://cgiaar.sharepoint.com/:b:/s/CIP/ddgr/sns/ESY3nECPxE9JubdZujJtE0BU78ifJQYO1vOyNn9LevOMQ?e=kP GJdH>

<https://hdl.handle.net/10568/114824>

Annex 7. COVID-19 protocols for potato farmers and project staff.

Medidas COVID-19

Para agricultores y técnicos que realizan labores en el cultivo de papa

Antes de iniciar las labores, el técnico a cargo dará las instrucciones necesarias de acuerdo a la situación de emergencia y/o cuarentena

Acondicionar un bidón con agua (20 L) para el lavado de manos. Este debe realizarse por espacio de 20 a 30 segundos con agua y jabón al llegar al campo, antes y después de almorzar o ir al baño y al retirarse a casa.

✓ Cuando estornuda o tosa, taparse la boca con el brazo o antebrazo y lavarse las manos. O también utilizar un pañuelo descartable.

Utilice en todo momento el Equipo de Protección Personal (EPP): el uso de mascarillas y guantes es obligatorio.

Durante las actividades de campo y los refrigerios, deben usar botellas e insumos personales.

✗ No saludar estrechando las manos. No abrazos.

2 METROS

Durante las actividades de campo, deben guardar una distancia mínima de 2 metros entre personas. Una persona debe realizar las labores en un surco y la otra debe estar después de 2 surcos para evitar el contacto entre ellos.

El personal de campo NO debe ser mayor de 65 años (personas con enfermedades de riesgo: diabetes, obesidad, presión alta).

65 AÑOS

En este contexto, y como medida preventiva, sugerimos llevar a cabo la Evaluación COVID-19 (triaje) que el gobierno ha implementado en su página web:

www.gob.pe/triaje

El COVID-19 es una enfermedad respiratoria que se transmite de persona a persona. Se sugiere tomar las siguientes medidas de prevención: mantener una distancia mínima de 2 metros entre personas, usar mascarilla y guantes, evitar reuniones grupales y evitar viajar a zonas con alta incidencia de la enfermedad. Esta publicación es una herramienta de apoyo para el personal de campo y no debe ser utilizada como único criterio de decisión. Se recomienda consultar con el personal de salud local para más información.

Annex 8. Guide of good nutritional practices for infants.



Link to the document (in Spanish):



https://cgiaar.sharepoint.com/:b:/s/CIP/ddgr/sns/Eee_QPE440VBieSGgMuhQrEBxXEJaAYelpwSjHVsNyMLXw?e=4kobKE



<https://doi.org/10.4160/9789290606307>

Annex 9. Zero Anemia Project: databases published.

Tema de Base de datos	Citation	Link
Línea de Salida de Conocimientos, Actitudes y Prácticas (CAP) sobre Anemia en zonas de estudio Proyecto Zero Anemia, La Libertad, Perú	Suarez, Victor; Fonseca, Cristina; Hareau, Guy; Pradel, Willy; Carrasco, Miluska; Bartolini, Rosario; Pinedo, Felipa; Otiniano, Ronal, 2022, "Dataset for: Línea de salida de Conocimientos, Actitudes y Prácticas (CAP) sobre Deficiencia de Hierro (Anemia) en familias productoras de papa en la Sierra de La Libertad (September – October 2021)", https://doi.org/10.21223/KYD5D7 , International Potato Center, V1,	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/KYD5D7 (publicado 02 Febrero 2022)
Línea de Base de Conocimientos, Actitudes y Prácticas (CAP) sobre Anemia en zonas de estudio Proyecto Zero Anemia, La Libertad, Perú	Suarez, Victor; Fonseca, Cristina; Hareau, Guy; Pradel, Willy; Carrasco, Miluska; Bartolini, Rosario; Pinedo, Felipa; Otiniano, Ronal, 2022, "Dataset for: Línea de base de Conocimientos, Actitudes y Prácticas (CAP) sobre Deficiencia de Hierro (Anemia) en familias productoras de papa en la Sierra de La Libertad", https://doi.org/10.21223/G3RMSH , International Potato Center, V1	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/G3RMSH (publicado 02 Febrero 2022)
Impacto Productivo y Social del Covid-19 en Productores de papa de la Sierra Norte del Perú	Suarez, Victor; Fonseca, Cristina; Pradel, Willy; Hareau, Guy; Pinedo, Felipa; Otiniano, Ronal, 2021, "Dataset for: Impacto Productivo y Social del Covid-19 en Productores de papa de la Sierra Norte del Perú en 2021", https://doi.org/10.21223/PREYUF , International Potato Center, V1	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/PREYUF (publicado 29 Noviembre 2021)
Monitoreo del piloto de intervención Papas “Puño de Hierro”: Distribución y uso de semilla	Suarez, Victor; Fonseca, Cristina; Pradel, Willy; Hareau, Guy; Villanueva, Cristian; Pinedo, Felipa; Otiniano, Ronal, 2021, "Dataset for: Monitoreo del piloto de intervención Papas “Puño de Hierro” Distribución y uso de semilla", https://doi.org/10.21223/PRUOEG , International Potato Center, V1	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/PRUOEG (publicado 29 Noviembre 2021)
Health crisis and quarantine measures in Peru: Effects on livelihoods of potato farmers: Stakeholders survey	Suarez, Victor; Fonseca, Cristina; Pradel, Willy; Hareau, Guy, 2021, "Dataset for: Health crisis and quarantine measures in Peru: Effects on livelihoods of potato farmers: Stakeholders survey", https://doi.org/10.21223/46KVFG , International Potato Center, V1	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/46KVFG (publicado 21 Enero 2021)
Health crisis and quarantine measures in Peru: Effects on livelihoods of potato farmers: Potato producers survey	Suarez, Victor; Fonseca, Cristina; Pradel, Willy; Hareau, Guy, 2021, "Dataset for: Health crisis and quarantine measures in Peru: Effects on livelihoods of potato farmers: Potato producers survey", https://doi.org/10.21223/KLUBXA , International Potato Center, V1	https://data.cipotato.org/dataset.xhtml?persistentId=doi:10.21223/KLUBXA (publicado 21 Enero 2021)

Annex 10. Photos (all photo credits: Asociacion Pataz)

 <p>01/03/2021 10:14:05 a.m.</p>	 <p>04/05/2021 12:47:21 p.m.</p>
<p>Women and men producer groups conduct participatory evaluation of biofortified potato clones at flowering (Curgos, March 2021).</p>	<p>Women and men producer groups conduct participatory evaluation of biofortified potato clones at harvest (Chugurpampa, May 2020).</p>

 <p>19 jun. 2021 11:51:29 a.m.</p>	 <p>29 jun. 2021 10:18:40 a.m.</p>
<p>Seed selection and packaging of native potato variety Huevo de Indio and three biofortified advanced potato clones for distribution to beneficiary families of the Zero Anemia project (Curgos, May 2021).</p>	<p>The mayor of Curgos District Municipality delivers potato seeds to beneficiary families of the Zero Anemia project (Curgos, May 2021).</p>



Mothers of children < 3 attend a nutritious food cooking demonstration session for beneficiary families (Calvario - Curgos, February 2021).



Health care personnel conduct training about infant anemia to beneficiary families (Chugurpampa - Julcán, June 2021).



Comprehensive healthcare campaign with support of Municipality of Curgos and Health Micro-Networks (Curgos - Curgos, April 2021).



Flier promoting the first virtual nutritional food recipe contest organized by Curgos District Municipality (Curgos - Curgos, January 2021).



Training session on nutrition to health workers.



Training session on nutrition for mothers.



Potato crop management training session.



Assessment of biofortified clones at harvest.