

SAM Photo Diagnosis App project

« Improving severe acute malnutrition diagnosis applying Geometric Morphometric techniques »

- ▶ **Duration of the Project:** 16 months, from December 2015.
- ▶ **Area of intervention:** This multisite study will take place primarily in Spain to design a methodology based in Geometric Morphometric techniques which will be applied ultimately in a region with high SAM prevalence to achieve the shape of a healthy child and a marasmic child.
- ▶ **Objective of the Project:** Providing an alternative tool for the nutritional status diagnosis of children aged under-five, by means of a mobile App development which will apply Geometric Morphometric techniques to photos of documented healthy and marasmic children – taken with a smartphone or tablet – allowing for a quantifiable comparison between the body shape of both groups and so, permitting the classification of future children photos in one of those groups with a high percentage of accuracy.
- ▶ **Consortium:** Lead: ACF-Spain // Partners: ACF-UK, Epinut Research Group from Complutense University of Madrid
- ▶ **Budget:** 187.904,41 \$

▶ Context

Currently, on humanitarian emergency settings, anthropometry provides the only plausible diagnostic method for nutritional status in children aged under-five due to the need for speed and simplicity but also for efficiency and efficacy. However, anthropometric measurements require expert staff with previous training. The development of an easy-to-use diagnostic tool based on the mobile phone technology could help to the community management of child undernutrition.

In the last decade there has been a huge advance in the knowledge and application of the morphometric methods in the study of the human body shape being the most innovative that based in geometric forms as triangles. Geometric Morphometric multivariate analysis allows the assessment of the shape recorded in any type of image (photography, scan, x-ray, etc.). The hypothesis of this research is that the body shape of a healthy child with normal weight differs from another with malnutrition and that these differences can be measured using Geometric Morphometric techniques to improve the diagnosis of the disease.

- ▶ **Objective:** The “SAM Photo Diagnosis App” project is divided into four main steps with specific objectives:

Step 1: To test if Geometric Morphometric techniques can be used to determine the body shape of a child. This technique has been used before to describe the shape of some parts of the body of an adult human such as the face and some bones but never has been used before in children and for the whole body shape so it is necessary to create a new landmarks configuration based on anthropometry. This step will be developed with the cooperation of 150 Spanish children from nurseries located in Madrid.

Step 2: To describe the morphometric configuration of a normal weight child valid for both sexes and between 6 months and five years old. This step will take place in some country still to be determined, in which the prevalence of severe acute malnutrition is high. There will be measured 150 healthy and normal weighed children classified by classical anthropometry.

Step 3: To describe the morphometric configuration of a marasmus child valid for both sexes and between 6 months and five years old. This step will take place in the same region of step 3 but measuring 150 children diagnosed as marasmic and not suffering other diseases.

Step 4: To develop a mobile phone app which classifies a child through the body shape. The ACF-Spain informatics developer team will create an app which will be able to place the landmarks in a picture taken with a smartphone to assess the body shape of a child from 6 months to 5 years old. Thereafter the app could be improved to compare the body shape obtained from a picture of a child with the average configuration of well-nourished or malnourished children to classify his nutritional status.

► Beneficiaries

- Final beneficiaries are children with severe acute under-nutrition that could be diagnosed earlier having a faster access to the treatment.
- Direct beneficiaries are communities that could improve the management of severe acute malnutrition from within without the need of a NGO support.
- Indirect beneficiaries are international organizations that could use the new tool to develop nutritional surveys in the crisis regions where the access is difficult for any reason.

► Methodology

Children participating in the study will be measured by anthropometry and weight (kg), height (cm), sitting height (cm), head circumference (cm) and MUAC (mm) will be recorded. Only those children that have a specific nutritional status (normal weight or marasmus depends on the step) will be photographed in different views depending on their height. Over the pictures, landmarks type I (those on well-defined anatomic points) will be marked and their coordinates X and Y will be digitized with the free software "TPSdig 2.0". By overlapping the landmarks of the whole sample, the software can obviate the size relative to age and take in to account only the shape, creating the geometric morphometric models. Through multivariate statistical analysis conducted with "MorphoJ" and "R" free softwares, these models can be related to the nutritional status assessing by anthropometry and can allow the identification of those parts of a child picture that are discriminants of the marasmus.

► Project Implementation Plan

Milestone	Start-End dates	Expected Outputs
Create new landmark configuration valid for a child aged between 6 months and 5 years	Dec 2015 – July 2016	Describe the general body shape of children aged under-five through Geometric Morphometrics
Create new landmark configuration of healthy and normal-weighted children aged under 5 years	July 2016 – Feb 2017	Describe the body shape of healthy children aged under-five in a context of high prevalence of SAM
Create new landmark configuration of undernourished children aged under 5 years	July 2016 – Feb 2017	Describe the body shape of children with marasmus
Develop the discriminant algorithm that differentiates shapes of healthy and undernourished children	Feb 2017 - Mar 2017	Achieve new method for diagnose the nutritional state through body shape analysis
Develop a mobile App that applies Geometric Morphometric technique to digital photographs	Apr 2016 – Mar 2017	Automate the processes of getting the body shape from a photo, apply the algorithm and diagnose the nutritional status of a child
Socialization of the project to academic and humanitarian staff	May 2016 - Mar 2017	Create documents and web resources that enable the opening of the obtained knowledge

► Impact of the project

This project could **improve the community management of child malnutrition through an innovative and easy-to-use tool**: the smartphone app allows the user to diagnose the nutritional status of each child letting him to get the required treatment faster and this tool could also be used to develop periodic surveys in the community without the presence of the NGOs. Eventually, the knowledge about the shape of normal weight and undernourished children **could let identify new anatomical regions, easy to measure, that can distinguish between both nutritional statuses.**

► Contacts

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