

Research Application Summary

Effect of the use of lucky iron fish on the prevalence of anaemia in women of reproductive age through a community-based intervention in the southern part of Benin

Gnamlin, L.,¹ Achamou, M.,^{1*} Boyiako, B.,^{1,2} Adoukonou, A.¹ & Fanou-Fogny, N.,¹

¹School of Nutrition, Food Sciences and Technologies, Faculty of Agronomic Sciences, University of Abomey-Calavi, 01 BP 526 Cotonou, Benin

²Laboratory of Food Nutrition and Technology, Faculty of engineering, University of Eduardo Mondlane, Maputo, Mozambique

Corresponding author: manchaachamou@gmail.com

Abstract

Iron deficiency anaemia is a public health problem in developing countries. In Benin, the prevalence of anaemia is still high despite the efforts made to address it. The Lucky Iron Fish is a new product that has been developed to tackle iron deficiency anaemia in settings where it prevails. This study assessed the effect of the use of Lucky Iron Fish on the prevalence of anaemia in women of reproductive age before its introduction in their dietary patterns. In this regard, a 70-week longitudinal experimental research was conducted in the commune of Adjohoun, Department of Oueme in South Benin. With the use of a semi-randomized non-blinded design, the study recruited 250 women of reproductive age gathered in two groups: the treatment group receiving the LIF and nutrition and the control group receiving nutritional education alone. Haemoglobin concentration and the prevalence of anaemia, iron intake and consumption frequency of protein and iron-rich foods were the main data collected. Findings revealed a positive effect of the use of LIF on the treatment of moderate anaemia. Iron deficiency anaemia prevalence decreased by 80%. The treatment group women's mean concentration of haemoglobin (9.45g/dl) increased at the end of this study (12.95g/dl) and was significantly ($p<0.05$) higher than that of women of the control group (11.06g/dl). Upcoming iron-deficiency anaemia related studies should use biological indicators of iron deficiency such as Ferritin and C-reactive protein (CRP) to detect inflammatory processes to increase the specificity of ferritin as an iron deficiency indicator.

Keywords: Benin, haemoglobin concentration, iron deficiency, LIF, longitudinal research, Women of reproductive age

Résumé

L'anémie ferriprive constitue un problème de santé publique dans les pays en développement. Au Bénin, la prévalence de l'anémie demeure élevée malgré les efforts déployés pour y faire face. Le "Lucky Iron Fish" (LIF) a été conçu pour lutter contre l'anémie ferriprive dans les milieux où l'anémie sévit. La présente étude a pour objectif d'évaluer l'effet de l'utilisation du LIF sur la prévalence de l'anémie chez les femmes en âge de procréer en prélude à toute action d'introduction de ce dernier dans les habitudes alimentaires au Bénin. A cet égard, une étude longitudinale, semi-randomisée non aveugle de 70 semaines, a été menée dans la commune d'Adjohoun située dans le département de l'Ouémé au Sud-Bénin. Un recrutement de 250 femmes en âge de procréer a été effectué et ces dernières étaient classées en deux groupes: le groupe expérimental recevant le LIF

et l’éducation nutritionnelle et le groupe témoin ne recevant que l’éducation nutritionnelle. Le taux d’hémoglobine et la prévalence de l'anémie, l'apport en fer et la fréquence de consommation d'aliments riches en protéines et en fer étaient les principales données collectées. L'utilisation du LIF a eu un effet positif sur le traitement de l'anémie modérée. La prévalence de l'anémie ferriprive a diminué de 80 %. Le taux moyen d'hémoglobine des femmes du groupe expérimental (9,45 g/dl) avait augmenté à la fin de l’étude (12,95 g/dl) et était significativement ($p<0,05$) plus élevé que celui des femmes du groupe témoin (11,06 g/dl). Pour des études futures, nous recommandons l’utilisation des indicateurs biologiques de carence en fer tels que la ferritine et la protéine C réactive (CRP) pour détecter les processus inflammatoires afin d'augmenter la spécificité de la ferritine en tant qu’indicateur de la carence en fer.

Mots clés : Bénin, concentration en hémoglobine, carence en fer, femmes en âge de procréer, LIF, recherche longitudinale

Introduction

In Benin, nearly 72% of children (6-59 months) and 58% of women (15-49 years) are anaemic (MPD and INSAE, 2018). Iron deficiency has been shown to significantly contribute to a wide range of adverse health outcomes in women. To address the nutritional causes of anaemia, several nutrition programs have been developed and implemented (WHO, 2016). However, the side effects of oral iron supplements (Low *et al.*, 2016), low access to varied diets and expensiveness of supplementation programs (Armstrong, 2017) in developing countries remain important bottlenecks.

Lucky Iron Fish (LIF) was developed to serve as an effective alternative (Armstrong, 2017). Clinical researches were conducted in countries such as Cambodia, the Dominican Republic and Guatemala to provide evidence of the efficacy of iron ingot use in different population groups (Charles, 2015; Rodríguez-Vivaldi and Beerman, 2018).

Efforts to reverse the anaemia trend in Benin have been effective until 2012. From that moment to date, the prevalence of the latter is on the rise. (MPD and INSAE, 2018). Given this situation, there is a need to develop novel methods of anaemia treatment. Drawing on a semi-randomized non-blinded study design, this research aims to assess the effect of the use of Lucky Iron Fish on the prevalence of anaemia in women of reproductive age through a community-based intervention in the southern part of Benin.

Methodology

This study was longitudinal experimental research that used a semi-randomized non-blinded design with two groups of women of reproductive age: the treatment group receiving the lucky iron fish (LIF) and the control group that did not. It was carried out from May 2019 to December 2020 at the community level in 10 villages of the commune of Adjohoun in South Benin. The intervention consisted of nutritional education activities on the efficient use of protein and iron-rich resources as well as dietary diversification for combating iron deficiency and anaemia. Both treatment and control groups participated in nutrition education activities. Main parameters followed-up included haemoglobin concentration and the prevalence of anaemia, iron intake and frequency consumption of protein and iron-rich foods.

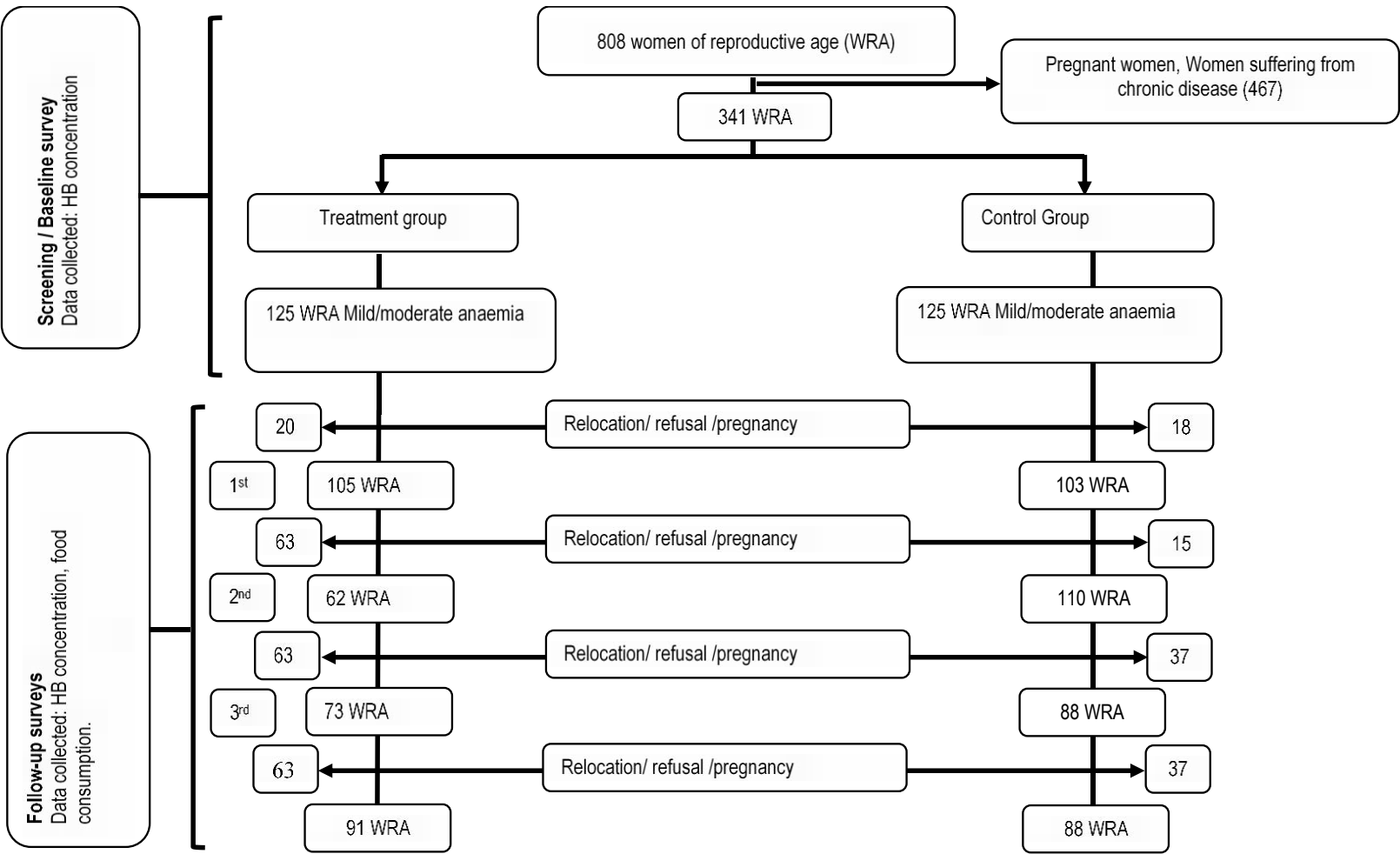


Figure 1. Study design

The data analysis was carried out in SPSS 25.0 (IBM Crop., Armonk, NY).

Results

The study design is shown in Figure 1. To recruit the 250 women with moderate anaemia, screening with a haemoglobin test was performed on a sampling frame of 808 women. Of the 808 women enrolled at the onset of the study, 558 were discarded due to the presence of pregnancy, chronic diseases, use of iron supplements and absence of mild/moderate anaemia and 179 had completed the study. Women of the treatment group dropped more out of the study than those of the control group did. The rate of dropout in the treatment and control group were respectively: 16% and 14% (2nd follow-up); 50% and 12% (3rd follow-up); and 42% and 30% participate (4th follow up). The main reasons for this decrease are relocation, pregnancy or refusal of the respondents to continue to participate in the study.

Five haemoglobin tests were carried out respectively in the control and treatment groups. The women's mean concentration of haemoglobin in the treatment group (9.45g/dl) was lower than that of the control group women (10.54g/dl) at the onset of the study. It increased during the study period (10,98g/dl six months later) and was (12.95g/dl) significantly ($p < 0.05$) higher than that of women of the control group (11,06g/dl) at the end.

The Prevalence of anaemia in both groups is shown in Table 1. Before the intervention, all the women (100%) of the treatment group suffered from moderate anaemia whereas only 16% of those of the control group were affected by it. At the end of the study, the prevalence of moderate anaemia significantly decreased amongst treatment group women (20%). As for the control group women, the share of those who suffered from moderate anaemia remained more or less the same (11.43%).

Table 1. Prevalence of anaemia among women of control and treatment group

Test	Prevalence (%)	Control Group n=55	Treatment group n=35
May 2019	Mild	83.4	0
	Moderate	16.36	100
	Non-anaemia	0	0
	Severe	0	0
September 2019	Mild	60	54.29
	Moderate	16.36	22.86
	Non-anaemia	23.64	20
	Severe	0	2.86
December 2019	Mild	62.86	58.18
	Moderate	20	21.82
	Non-anaemia	17.14	16.36
	Severe	0	3.64
June 2020	Mild	51.43	65.45
	Moderate	25.71	10.91
	Non-anaemia	22.86	23.64
	Severe	0	0
December 2020	Mild	62.86	52.73
	Moderate	11.43	20
	Non-anaemia	25.71	27.27
	Severe	0	0

Our findings are consistent with those of some studies conducted in Cambodia (Charles 2015) and Guatemala (Rodríguez-Vivaldi and Beerman 2018). Conversely, reusable fish-shaped iron ingot and cooking iron pot had been respectively proven ineffective in Iron deficiency anaemia treatment in Cambodia (Rappaport *et al.*, 2017) and Benin (Sharieff *et al.*, 2008). In the first study (n=340 women of reproductive age), they found no significant difference in mean haemoglobin concentrations between the iron-ingot group (115 g/L; 95% CI: 113, 118 g/L; $P = 0.850$) and the control group (115 g/L; 95% CI: 113, 117 g/L) at 12 month. The authors suggested that this may be due to the low prevalence of iron deficiency at baseline (9%) based on serum ferritin concentrations in the population of the study (Rappaport *et al.*, 2017). Our study population did not suffer from genetic haemoglobin disorders nor did we use ferritin serum to assess an iron deficiency because of some logistic constraints. In reality, as part of community-based studies, haemoglobin is the sole accurate indicator and easily measurable *in situ* to do a quick screening of iron deficiency anaemia (WHO, 2011). In addition, it is widely acknowledged that 50% of global anaemia is due to Iron deficiency anaemia (De Benoist, WHO, CDCP, 2008). In the second study (Sharieff *et al.*, 2008), the reason why their findings are different from ours may be due to their population of the study, especially young children (6–24 months), previously reported for having a high iron requirement (Sharieff *et al.*, 2008). Differences in the intervention's context may be a reason as well.

Conclusion

This study aimed to assess the effect of the use of Lucky Iron Fish (LIF) on the prevalence of anaemia among women of reproductive age through a community-based intervention in the southern part of Benin. Results revealed that a steady consumption of LIF improved the iron status of women suffering from mild and moderate anaemia. For prospective research, it would be worthwhile to make use of biological indicators of iron deficiency such as Ferritin and C-reactive protein (CRP) to detect inflammatory processes to increase the specificity of ferritin as an iron deficiency.

Acknowledgement

This research work is the outcome of concerted work and contribution of different institutions which our gratitude goes to: i) the staff of Care International NGO in Benin, ii) the laboratory of Nutrition of the Faculty of Agronomics Sciences of Abomey-Calavi University. This paper is a contribution to the Seventh Africa Higher Education Week and RUFORUM Triennial Conference 2021 held 6-10 December 2021 in Cotonou, Benin.

Reference

- Armstrong, G. R. 2017. The Lucky Iron Fish: A Simple Solution for Iron Deficiency. *Blood Advances* 1 (5): 330–330. <https://doi.org/10.1182/bloodadvances.2016000521>.
- Charles, C. V. 2015. A Randomized control trial using a fish-shaped iron ingot for the amelioration of iron deficiency anemia in rural Cambodian women. *Tropical Medicine & Surgery* 03 (03). <https://doi.org/10.4172/2329-9088.1000195>.
- De Benoist, Bruno, World Health Organization, and Centers for Disease Control and Prevention (U.S.). 2008. Worldwide Prevalence of Anaemia 1993-2005 of: WHO Global Database of Anaemia. Geneva: World Health Organization. <http://whqlibdoc.who.int/>

- publications/2008/9789241596657_eng.pdf.
- Ministère du plan et du développement (MPD) et Institut National de statistiques et d'économie appliquée (INSAE). 2018. Cinquième Enquête Démographique et de Santé au Bénin (EDSB-V) 2017-2018, 675pp.
- Low, M.S.Y., Speedy, J., Styles, C.E., De-Regil, L.M. and Pasricha, S.R. 2016. Daily iron supplementation for improving anaemia, iron status and health in menstruating women. *Cochrane Database of Systematic Reviews* 4: 1-182.
- Rapaport, Aviva I, Kyly C Whitfield, Gwen E Chapman, Rickey Y Yada, Khin Meng Kheang, Jennie Louise, Alastair J Summerlee, Gavin R Armstrong, and Timothy J Green. 2017. Randomized controlled trial assessing the efficacy of a reusable fish-shaped iron ingot to increase hemoglobin concentration in anemic, rural Cambodian women. *The American Journal of Clinical Nutrition* 106 (2): 667–74. <https://doi.org/10.3945/ajcn.117.152785>.
- Rodríguez-Vivaldi, Ana María, and Kathy Beerman. 2018. Testing the efficacy of the lucky iron fish® in reversing iron deficiency anemia in rural, impoverished regions of Guatemala. *Journal of Global Health Reports* 2: e2018014. <https://doi.org/10.29392/joghr.2.e2018014>.
- Sharieff, Waseem, Joyce Dofonsou, and Stanley Zlotkin. 2008. Is cooking food in iron pots an appropriate solution for the control of anaemia in developing countries? A Randomised clinical trial in Benin. *Public Health Nutrition* 11 (9): 971–77. <https://doi.org/10.1017/S1368980007001139>.
- WHO. 2011. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization.
- WHO. 2016. Guideline. <http://www.ncbi.nlm.nih.gov/books/NBK361888/>.