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EFFECT OF 12 WEEKS CONSUMPTION OF PALM WEEVIL LARVAE AND ORANGE-FLESHED SWEET POTATO FORTIFIED BISCUIT ON NUTRITIONAL STATUS AND COGNITIVE PERFORMANCE OF SCHOOL CHILDREN IN KUMASI, GHANA

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ABSTRACT

Micronutrients are important for improving the physical growth and cognition of school-aged children. Food fortification strategies using locally available and consumed micronutrient rich foods such as edible insects can be cost effective and sustainable in improving nutritional and cognitive outcomes in school children. The study evaluated the impact of biscuits fortified with palm weevil larvae and orange-fleshed sweet potato on cognitive performance and nutritional status of school children from low income families in an urban setting in Ghana. A 12-week randomized, blinded controlled trial was conducted. 102 school children aged 6-11 years were assigned to consume either the fortified biscuits or non-fortified biscuits. Raven's cognition test, anthropometrics, hematological and biochemical parameters were assessed at baseline and at the end of the study. After 12 weeks of intervention, there were no statistically significant differences in the means of the nutritional outcomes and cognitive performance between the treatment and control groups ($p>0.05$). However, significant increase in mean levels of serum ferritin (Baseline: $26.15 \pm 18.42 \mu\text{g/L}$, Endline: $42.63 \pm 19.54 \mu\text{g/L}$, mean increase: $+16.48 \mu\text{g/L}$, $p=0.001$), weight-for-age (Baseline: -0.37 ± 0.97 , Endline: -0.11 ± 0.91 , mean increase: $+0.26$, $p<0.0001$), and Raven's cognition test score (Baseline: 14.22 ± 4.93 , Endline: 16.35 ± 4.40 , mean increase: $+2.13$, $p<0.0001$) were observed within the treatment group compared to the control group where significant increase was observed in only the Ravens cognition test score (Baseline: 14.79 ± 4.57 , Endline: 15.95 ± 5.32 , mean increase: $+1.16$, $p<0.029$). Moreover, the mean increase in cognition score was higher in intervention ($+2.13$) than control ($+1.16$) children. Results from binary logistic regression showed that although statistically insignificant, children in the treatment group had lower odds of iron deficiency (AOR= 0.7, $p = 0.545$, 95%CI= 0.2-2.4). In conclusion, consumption of the fortified biscuit significantly improved serum ferritin and weight-for-age in the school-aged children within the treatment group. Improvement in cognitive test score was also higher in the treatment group than the control group.

Key words: Fortified biscuit, cognition, micronutrients, school children, palm weevil larvae, insects

INTRODUCTION

School-aged children (SAC) need adequate micronutrients for optimal growth and cognitive development [1]. However, micronutrient deficiencies remain widespread among SAC in most developing countries with dire adverse consequences such as growth retardation and poor cognitive function [2,3]. SAC are usually at risk of deficiencies in iron, iodine, zinc, vitamin A, vitamins B₆ and vitamin B₁₂ and these nutrients play important roles in ensuring physical growth and improving cognitive development and performance [4,5,6,7,8].

Several intervention strategies have been used to improve micronutrient status, cognitive performance, growth and decrease anemia prevalence among SAC [9,10,11]. Food based approaches such as food fortification and diversification are considered cost effective and sustainable especially when they involve the use of locally available and consumed foods that are good sources of multiple nutrients [12].

Palm weevil larvae (PWL) (*Rhynchophorus phoenicis fabricius*) is an edible insect consumed mainly in rural communities in most countries in West Africa including Ghana [13]. It is nutritionally rich in protein, essential amino acids and micronutrients such as zinc, iron, and B vitamins [13,14]. Orange-fleshed sweet potato (OFSP) which is also a staple food is rich in beta-carotene and its consumption has played a role in combating vitamin A deficiency among children [15,16]. Vitamin A intake is also known to influence iron status in individuals due to its effect on iron absorption and metabolism [17,18].

Snack consumption is common among SAC though most of these snacks are high-fat and energy dense with low nutrient density [19]. Fortifying or enriching snack foods with micronutrient rich foods such as PWL and OFSP could therefore be useful in improving micronutrient status and subsequently cognitive outcomes of school children. Moreover, schools offer an opportune platform to deliver enriched meals and snacks to children who are undernourished [20].

In Ghana, the few nutritional studies suggest that SAC suffer from nutrition related problems and micronutrient deficiencies [21,22,23]. However, there is a dearth of information regarding the use and effects of food based intervention strategies on improving micronutrient status and cognitive outcomes of Ghanaian SAC. Besides the use of edible insects and other locally available nutrient rich foods in food based intervention strategies has not been fully explored and given sufficient attention in Ghana particularly among school children.

The aim of this study is to investigate the effect of OFSP and PWL fortified biscuit on the nutritional status and cognitive performance of SAC from low income families in the Kumasi Metropolis, Ghana.

MATERIALS AND METHODS

Study design and sample size determination

A blinded randomized controlled intervention trial was conducted among primary school children from low income families attending a government-owned school in the Kumasi Metropolis of the Ashanti Region, Ghana. The sample size was estimated using the G* power statistical software version 3.1.9.7 (gpower.hhu.de) and adopting a medium-sized effect, $d = 0.56$ [24], level of significance (α) = 0.05 and power ($1-\beta$) = 0.80 demonstrated that a total sample size of 82 is appropriate for the study. However, to cater for non-responses and dropout of participants, 132 children between 6 to 11 years in the school were invited to take part in the study. These children were further screened based on the inclusion and exclusion criteria. This resulted in 117 participants considered to be eligible for the study. Parents of 103 pupils consented to the study. Participants were initially randomized into either control ($n = 51$) or treatment ($n = 52$) groups using Statistical Package for Social Sciences version 25 (SPSS). One participant in the control group dropped out after randomization before the actual start of the study. The two groups were coded to blind the teachers and the pupils as to which group was the treatment group or the control group.

The inclusion criteria were being between 6 – 11 years old, physically and mentally healthy to participate in study, whose parents or guardians consented and were at the time of the study not taking any medication or dietary supplements.

The exclusion criteria were not being physically or mentally healthy to participate in the procedures, not having parental or guardians consent and taking any long term medication or dietary supplements.

Ethical consideration

Ethical approval was obtained from the Committee on Human Research, Publications and Ethics at Kwame Nkrumah University of Science and Technology. Permission was obtained from the Kumasi Metropolitan Education Directorate and the head teacher of the school. Written informed consent was obtained from parents or guardians of the pupils while the children gave their assent.

Sociodemographic data collection

A pre-tested questionnaire was administered to the study participants to obtain information about sociodemographic characteristics such as their age, educational status of parents/guardian, number of people in their household and who they lived with.

Anthropometric measurements

Anthropometric measurements were carried out at baseline and at the end of the study. All anthropometric measurements were taken in duplicates and the mean calculated. Height was measured to the nearest 0.1cm using a Seca 214 stadiometer. Weight was measured to the nearest 0.1kg using the Omron body composition monitor (Model HBF-514). Height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), and BMI-for-age (BAZ) z-scores were calculated using WHO AnthroPlus version 1.0.4. Children below negative two standard deviation ($-2SD$) according to the WHO median for WAZ, HAZ and BAZ were considered underweight, stunted or thin/wasted respectively. Normal was defined as z-score greater than or equal to $-2SD$.

Blood sampling and analysis

5ml venous blood was drawn from the study participants. 2ml of the blood was put into EDTA (Ethylene diamine tetra acetic acid) tubes to be used for hematological analysis using the Mindray Auto Hematological Analyzer (Model: BC-3000Plus, Germany). 3ml was placed in a serum separator tube to clot. In the laboratory the tube was centrifuged for 15 minutes for 4,000 rpm. The serum was subsequently aliquoted into micro tubes and stored at $-80^{\circ}C$ until they were analyzed. Human C-reactive protein Enzyme-Linked Immunosorbent Assay (ELISA) test kit (Catalogue number: JL-F46268) was used for C-reactive protein (CRP) analysis. Human ferritin ELISA test kit (Melson Shanghai Chemical Limited, China) and Human thyroglobulin ELISA test kit (Melson Shanghai Chemical Limited, China) was used to analyze serum ferritin (SF) and serum thyroglobulin, respectively.

Anemia was defined as hemoglobin concentration <11.5 g/dL. Serum ferritin concentration below $15 \mu\text{g/L}$ was defined as depleted iron stores. Thyroglobulin levels above $40 \mu\text{g/L}$ indicated low iodine levels. Concentration of CRP above 5 mg/L was considered an indication of acute phase response or inflammation among the school children. Children with CRP levels above 5 mg/L indicating inflammation or acute phase response were removed from the SF data during analysis.

Cognitive assessment

Cognitive assessment was performed using the Raven's Colored Progressive Matrices (RCPM) after pretesting among school children of similar age and socio demographic background. It is a non-verbal test designed for young children ages 5 -11 years [25]. The test was administered in the morning between 8am to 11am in a distraction free environment by well-trained research assistants. The test was administered individually using the RCPM printed booklet and score sheets. The examinee identifies the missing component from six multiple choice options in a series of figural patterns whilst the examiner ticks the options chosen by the examinee on the score sheet. The total score for the test is 36. The score for each examinee is simply the correct responses made.

Production of fortified and non-fortified biscuit

The preparation of the fortified biscuit was formulated using the method described in an earlier study with some modifications [26]. The fortified biscuit for the treatment group was made with PWL (40%), OFSP flour (15%) and iodated salt (2%) in addition to the basic ingredients which are margarine (fat), all-purpose wheat flour, sugar, baking powder and flavoring. The sugar and margarine were weighed, mixed and creamed together till fluffy. The weighed OFSP flour, all-purpose wheat flour, baking powder, iodated salt and flavoring were then added and mixed in to form a dough. The palm weevil larvae were washed, cleaned and parboiled. The parboiled PWL was then blended and sieved. The residue in the sieve was oven dried and milled into a powdery consistency. The blended PWL slurry and powder were mixed and kneaded into the dough. The dough was thinly rolled with a rolling pin on a table dusted with flour. The rolled dough was cut out into uniform shapes and sizes, arranged on greased baking trays and baked at 200°C for 20 minutes. The non-fortified biscuit for the control group was made with only margarine, all-purpose wheat flour, sugar, baking powder and flavoring following the same procedure. The baked biscuits were cooled and packaged in ziploc bags. The mineral content of the fortified and non-fortified biscuits was analyzed and presented in Table 1. The acceptability of the fortified biscuit based on taste, color, aroma and texture was pretested before distribution among primary school children of similar age and sociodemographic characteristics who did not participate in the study.

Distribution

A daily ration of 60g of fortified or unfortified biscuits was given to each child in the treatment or the control groups respectively. Both groups consumed the biscuits five (5) days a week during school days except on public holidays. To avoid the exchange of biscuits between the children, the two groups were separated into

different classrooms before daily distribution. To ensure compliance each child was requested to submit the empty ziploc bags that was used to package the biscuits after consumption. A list of children absent was prepared after each visit and their biscuits were given to the teachers to be given to them the following morning before the distribution that day.

After the 12-week intervention period, cognitive assessment, anthropometric measurements, biochemical and hematological assessment were repeated.

Data analysis

Data were analyzed using Statistical Package for Social Sciences version 25 (SPSS IBM Inc). Descriptive statistics were used to summarize the study variables. Comparisons of baseline characteristics between the treatment and control groups was analyzed using Chi-square test for categorical variables. Independent-samples t-tests were used to determine statistical significance for the group differences of continuous variables at baseline and at endline. Paired t-tests was used to determine significant mean differences within each group before and after the intervention. Binary logistic regression analysis was performed to determine the effect of intervention or group type on iron deficiency, anemia and cognitive test scores at the end of the intervention. P value < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

The SAC were enrolled into the control group (n=50) and treatment group (n=52). Seven children refused to continue daily consumption of the biscuits during the intervention period. Blood samples were not obtained from all the study participants due to refusal to have blood drawn or in some cases due to insufficient blood obtained. The study profile is presented in Figure 1.

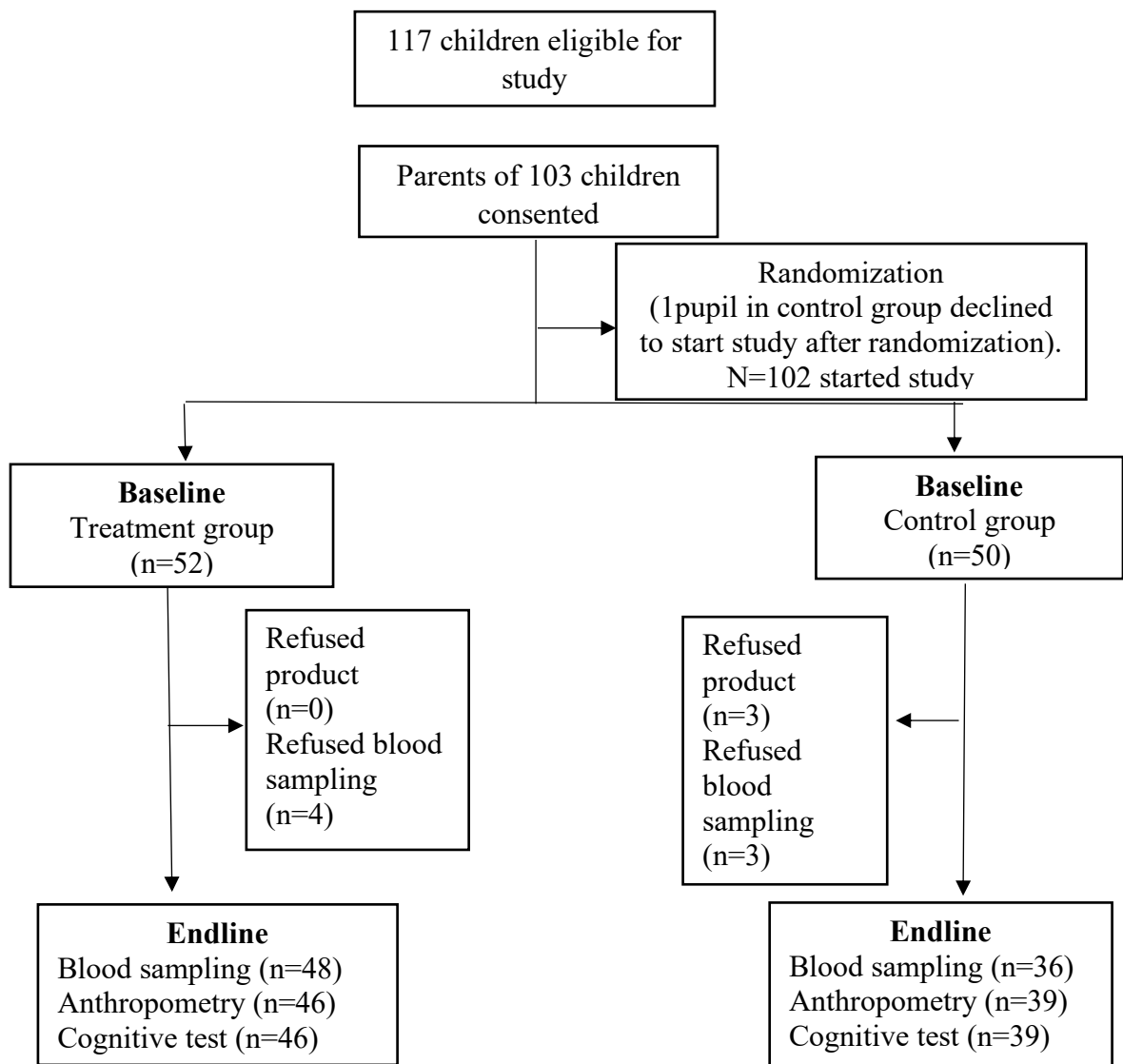


Figure 1: Study profile

Table 2 shows the comparison of baseline data between the treatment and control groups. The mean age of the study participants in both groups was 9 ± 1.44 years. No statistical differences were observed between the two groups for the variables considered except for household number.

At the end of the intervention period, there was no significant difference in RCPM test score, biochemical, hematological and anthropometric parameters between the two groups ($p > 0.05$) as presented in Table 3. However, within the treatment group, mean serum ferritin levels were significantly increased after the intervention ($p = 0.001$). Similarly, mean weight ($p < 0.001$), WAZ ($p < 0.001$) and RCPM test score ($p < 0.001$) significantly increased. Within the control group, observed increase for

all variables at the end of the intervention were not statistically significant except for the RPCM test score ($p=0.029$). The results are presented in Table 4.

Binary logistic regression analysis (Table 5) performed to determine the overall effect of group type (intervention or control) on hemoglobin levels, serum ferritin levels (iron deficiency) and cognitive performance showed that children in the intervention group had lower odds ($AOR= 0.8$, $p = 0.825$, $95\%CI= 0.2-3.2$) of iron deficiency indicated by low ferritin levels and higher odds ($AOR= 1.1$, $p = 0.805$, $95\%CI= 0.4-3.0$) of being anemic when age and gender were adjusted though not significant.

The study was designed to test the efficacy of biscuit fortified or enriched mainly with PWL and OFSP consumed for a 12-week period in improving nutritional status and cognitive performance of SAC. Biscuits were chosen as the food vehicle based on its ease of distribution and the fact that biscuits are a regular snacks consumed by most SAC [27,28]. Furthermore, incorporating the PWL in biscuits will make it more acceptable for consumption among this age group. Overall, the content of iron, zinc, beta carotene and other minerals in the fortified biscuit was significantly higher compared to the non-fortified biscuit. This can be attributed to the fact that PWL and OFSP are rich in essential minerals [13,14,15,26]. The relatively high micronutrient content in the fortified biscuit has the potential to improve the micronutrient status of school children.

At the end of the 12-week intervention period, increase in cognitive test score was not statistically significant between the treatment and the control groups ($p=0.706$). Improvement in cognitive test score was observed within both groups at the end of the study though it was relatively higher in the treatment group than the control group.

Evidence from a number of studies suggests that the effect of multiple micronutrient intervention on cognitive performance among school children remain inconsistent or equivocal. While some studies have shown a beneficial impact on short term memory, fluid intelligence, verbal learning and academic performance among SAC, in other studies no significant improvement in cognitive performance was observed [7,10,24,29,30,31]. The fortified biscuits for the treatment group contained more iron, zinc and beta carotene which are nutrients known to improve cognitive performance in children [6,8,10,29,32,33]. The non-significant improvement in cognitive performance between the treatment and control groups may have been due to the duration of the study. In fortification or food based intervention studies where improvement in cognition performance was observed in

older children, the average duration was 6 months. Again, in these studies, the food vehicles were fortified with mainly pharmaceutical or inorganic micronutrients premix with possibly high relative bioavailability rather than with foods naturally rich in micronutrients as pertained to this study [1,7,10].

Serum ferritin levels were significantly increased within the treatment group. Additionally, the odds of low serum ferritin levels indicating iron deficiency in the treatment group after intervention was relatively low (AOR= 0.8, $p = 0.825$, 95%CI= 0.2-3.2). From the results, there is a suggestion of improvement in iron status in the treatment group which may be more evident with a longer study duration. This could be due to the increased iron content in the fortified biscuit which provided approximately the (Recommended Dietary Allowance) RDA for iron (8mg/day) for children 9-13 years [34]. Secondly, the high beta carotene content of the fortified biscuit could have further enhanced the absorption of iron [18]. A study in Bangladesh showed that intake of micronutrient fortified biscuits by school children improved their serum ferritin levels among other micronutrients [28]. An 8-week intervention in India, with a micronutrient fortified milk also improved levels of serum ferritin and other micronutrients among children in the experimental group [11]. Nevertheless, in this study the increased serum ferritin levels observed within the treatment group was not adequate enough to result in a significant difference between the treatment and control groups after intervention even though the iron content in fortified biscuit (8.9mg/serving) was twice the amount in the non-fortified biscuit (4.1mg/serving). Increase in hemoglobin levels within the treatment group and between both groups at the end of the study was not observed to be significant. This is in contrast with what was observed in a study in Vietnam where hemoglobin levels were significantly increased in the treatment group after consuming a multiple micronutrient fortified biscuit [35]. Moreover, the study did not observe significant improvement in the iodine status of the treatment group as indicated by their thyroglobulin levels after the intervention period though the fortified biscuit contained iodated salt.

Within the treatment group significant increase in WAZ was observed. In Botswana, a study observed an increase in weight and WAZ in the treatment group. This reported increase in these growth indicators was attributed to increase in zinc and iron intake via the fortified beverage consumed [36]. The fortified biscuit used in this study contained iron and zinc to probably elicit a similar effect within the treatment group.

One major limitation was that at the end of the study a number of participants were not available for blood sampling due to refusal or absence from school. Another

limitation was the short duration of 12 weeks for the food based intervention which may not have been enough to elicit a greater impact on cognitive outcomes and nutritional status of the SAC.

CONCLUSION

Following 12 weeks of intervention, the effect of the PWL and OFSP fortified biscuit on improving cognitive performance and nutritional status of the SAC was equivocal. Within the treatment group though significant improvements in serum ferritin levels, WAZ and RCPM test score were observed, the observed improvements did not result in a statistically significant difference between the treatment and control groups. Nevertheless, fortification of biscuits with PWL and OFSP could be useful and appropriate in improving the nutritional value of biscuits for SAC. It is however recommended that further research is conducted where pupils will be exposed to the fortified biscuit for a longer period.

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Disclosure statement

The authors declare no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.



Table 1: Mineral content of PWL and OFSP fortified biscuit and non-fortified biscuit

Mineral	Mineral Content	
	Fortified Biscuit	Non-fortified Biscuit
Iron (mg/100g)	14.83 ^b ± 0.01	6.76 ^a ± 0.01
Zinc (mg/kg)	11.61 ^b ± 0.00	6.40 ^a ± 0.00
Beta carotene (mg/kg)	34.88 ^b ± 0.37	10.58 ^a ± 0.64
Calcium (mg/kg)	968.38 ^b ± 0.02	543.99 ^a ± 0.02
Potassium (mg/kg)	2527.84 ^b ± 0.06	1200.32 ^a ± 0.08
Magnesium (mg/kg)	727.92 ^b ± 0.05	219.01 ^a ± 0.03
Vitamin C (mg/100g)	8.53 ^b ± 0.35	5.12 ^a ± 0.21

Data represent mean of duplicate analyses ± standard deviation. Independent samples t-Test was used to compare means. Different alphabet superscripts in the same row represent significant difference between means (p<0.05).

Table 2: Baseline characteristics of the treatment and control groups

	Total N=102	Treatment n=52	Control n=50	p-value
Age				
Mean age	9.0 ± 1.4	8.8 ± 1.45	9.12 ± 1.44	0.413
6-8 years	38(37.3)	20(38.5)	18(36.0)	0.840
9-11 years	64(62.7)	32(61.5)	32(64.0)	
Gender				
Female	52(51.0)	31(59.6)	21(42.0)	0.113
Male	50(49.0)	21(40.4)	29(58.0)	
Mother's literacy				
Literate	31(36.9)	15(32.6)	16(42.1)	0.156
Illiterate	7(8.3)	2(4.3)	5(13.2)	
Don't know	46(54.8)	29(63.0)	17(44.7)	
Father's literacy				
Literate	48(75.0)	10(28.6)	4(13.8)	0.363
Illiterate	14(21.9)	1(2.9)	1(3.4)	
Don't know	48(75.0)	24(68.6)	24(82.8)	0.163
Living with				
Both parents	56(54.9)	29(55.8)	27(54.0)	0.50
Others	46(45.1)	23(44.2)	23(46.0)	
Household number				
1-5 people	37(36.3)	13(25.0)	24(48.0)	0.003
6-10 people	56(54.9)	37(71.2)	19(38.0)	
More than 10 people	9(8.8)	2(3.8)	7(14.0)	
Previous day's nutrient intakes (mean ± SD)				
Iron(mg)	8.87 ± 4.83	8.47 ± 4.70	9.30 ± 4.98	0.387
Zinc (mg)	5.82 ± 2.98	5.66 ± 2.96	5.98 ± 3.01	0.581
Vitamin A (IU)	1759.95 ± 1292.08	1638.03 ± 1137.32	1886.74 ± 1436.21	0.334
Prevalence n (%)				
Anemia	47 (49.5)	27 (56.3)	20 (42.6)	0.129
Iron deficiency	17(24.6)	10 (29.4)	7(20.0)	0.27
Iodine deficiency	86(100)	45 (100)	41(100)	-

Data are presented as frequency (percentage) or Mean ± SD,

†Fisher's exact p-value reported, ¥ Pearson chi-square p-value,

*independent t-test p-value

Table 3: Mean biochemical, hematological, anthropometric parameters and RCPM test score between control and treatment groups at baseline and after intervention

Variables	Baseline				After intervention			
	Control group	Treatment group	Difference	p-value	Control group	Treatment group	Difference	p-value
Hemoglobin (g/dL)	11.51 ± 0.94	11.45 ± 0.77	-0.056	0.749	11.60 ± 2.77	11.19 ± 2.50	-0.35	0.492
Ferritin (µg/L)	30.62 ± 18.78	28.44 ± 19.32	-2.17	0.637	41.36 ± 21.57	43.80 ± 20.75	2.43	0.65
Thyroglobulin (µg/L)	5.72 ± 1.28	5.70 ± 1.39	-0.017	0.952	5.70 ± 1.23	5.66 ± 1.36	-0.05	0.878
BMI (kg/m ²)	15.81 ± 3.24	15.55 ± 1.13	-0.26	0.584	15.7 ± 1.80	15.50 ± 1.22	-0.22	0.514
BAZ	-0.18 ± 0.95	-0.40 ± 0.70	-0.226	0.174	-0.42 ± 0.99	-0.40 ± 0.71	0.03	0.881
Weight (kg)	28.38 ± 7.7	26.53 ± 4.81	-1.86	0.146	28.27 ± 6.09	27.34 ± 5.04	-0.93	0.446
WAZ	-0.18 ± 1.06	-0.38 ± 0.96	-0.02	0.388	-0.07 ± 1.08	-0.11 ± 0.91	-0.04	0.877
RCPM test score	16.04 ± 5.33	14.67 ± 5.06	-1.37	0.187	15.95 ± 5.32	16.35 ± 4.40	0.4	0.706

Independent t-test was performed. Data presented as means ± standard deviation. p-value is significant at p<0.05

Table 4: Mean biochemical, hematological, anthropometric parameters and RCPM test score within the treatment and control groups before and after intervention.

Variable				p-value
	Baseline	After intervention	Mean difference	
Treatment group				
Hemoglobin (g/dL)	11.45 ± 0.77	11.65 ± 1.01	0.20	0.152
Ferritin(µg/L)	26.15 ± 18.42	42.63 ± 19.54	-16.47	0.001
Thyroglobulin(µg/L)	5.77 ± 1.48	5.55 ± 1.24	0.22	0.529
BMI (kg/m²)	15.56 ± 1.13	15.51± 1.22	0.05	0.427
BAZ	-0.37 ± 0.69	-0.40 ± 0.71	0.024	0.531
Weight (kg)	26.41± 4.88	27.35± 5.04	-0.93	<0.0001
WAZ	-0.37 ± 0.97	-0.11 ± 0.91	-0.26	<0.0001
RCPM test score	14.22 ± 4.93	16.35 ± 4.40	-2.13	<0.0001
Control group				
Hemoglobin(g/dl)	11.43 ± 0.79	12.00 ± 1.72	-0.57	0.05
Ferritin (µg/L)	28.86 ± 18.60	40.98 ± 19.94	-12.12	0.084
Thyroglobulin(µg/L)	5.53 ± 1.11	5.73 ± 1.25	-0.19	0.505
BMI (kg/m²)	15.41± 3.02	15.72 ±1.81	-0.32	0.523
BAZ	-0.31 ± 0.80	-0.42 ± 0.99	0.11	0.416
Weight (kg)	27.08 ± 5.51	28.27 ± 6.10	-1.19	0.228
WAZ	-0.41 ± 0.72	-0.07 ± 1.08	-0.33	0.060
RCPM test score	14.79 ± 4.57	15.95 ± 5.32	-1.15	0.029

Paired t-test performed. Data presented as means ±SD. p value is significant at p<0.05

Table 5: The relative risk ratios of RCPM test score, iron deficiency and anemia between intervention and control groups at end of intervention

Group	Cognition test score above 50 th percentile			
	Unadjusted OR(95%CI)	p value	Adjusted OR(95%CI)	p value
Treatment	1.0(0.4-2.3)	0.963	1.0(0.4-2.4)	0.964
Control	Ref		Ref	
	Anemia			
	Unadjusted OR(95%CI)	p value	Adjusted OR(95%CI)	p value
Treatment	1.1(0.4-3.0)	0.79	1.1(0.4-3.0)	0.805
Control	Ref		Ref	
	Iron deficiency (ID)			
	Unadjusted OR(95%CI)	p value	Adjusted OR(95%CI)	p value
Treatment	0.7(0.2-2.4)	0.545	0.8(0.2-3.2)	0.825
Control	Ref		Ref	

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