CLINICAL RESEARCH

The Use of Whatsapp Social Media Group for Nutrition Counselling among Parents with Children of Congenital Heart Defects

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ABSTRACT

Introduction	Ignorance about appropriate Infant and Young Child Feeding (IYCF) practices among parents with children of Congenital Heart Defects (CHD) can exacerbate malnutrition in these children leading to significant morbidity and mortality. The use of novel methods for Intensive Nutrition Counselling such as in a WhatsApp social media group can result in significant improvements in the child's nutritional status. Objective of this study is to assess the efficacy of WhatsApp group for Intensive Nutritional Counselling to parents with children of CHD.
Methods	This was a two-years prospective interventional study, one-group before-after study design, conducted at a tertiary care referral institute in Central India. Here, intervention is in the form of specialised focused nutrition counselling for parents of children with CHD through a WhatsApp social media group.
Results	The majority of the patients 16 (30.0%) were between the ages of 7 and 12 months, and the most common diagnosis in 25 patients (48.9%) was a Ventricular Septal Defect (VSD). 68.0% of patient-families belonged to the lower socio-economic classes. Before the intervention, 71.1% of children (37 of 52) were found to be underweight, 35.5% of children were stunted and 65.6% of children were wasted. Post intervention, there was 50.0% improvement in weight and 14.0% improvement in height. This intervention particularly helped improve IYCF habits for the age group of 7-12 months. Post-intervention, all parents included the 8 food groups in their children's diet, thus providing them with wholesome nutrition, whereas pre-intervention, parents only provided 2-3 food groups to children on a daily basis.
Conclusions	This was the first study to explore the use of WhatsApp groups to educate parents of children with CHD about specific nutrition counselling, resulting in an improvement in all 3 child anthropometric indices.
Keywords	WhatsApp - Mobile health - Congenital heart defects - CHD - Infant and Young Child Feeding - IYCF.

INTRODUCTION

Congenital Heart Defects (CHD) account for nearly one-third of all major congenital anomalies with an incidence of 8-10 per 1000 live births reported from different parts of the world.[1] In India, with a crude birth rate of 23.5 per 1000 live births, approximately 200,000 children are born with CHD annually. An estimation of 10.0% of the present infant mortality in India may be accounted for CHD alone.

Malnutrition is a common cause of morbidity in children with CHD.[2,3,4] Faulty and deficient feeding practices in children with CHD further aggravates malnutrition in these kids. Ignorance about appropriate Infant and Young Child Feeding (IYCF) practices among parents of children with CHD can further exacerbate malnutrition in these children leading to a considerable morbidity and mortality.

This research project was conducted at an Institute in Central India that is a tertiary referral super specialty centre that offers completely free treatment for paediatric CHD.[5,6] Since its inception in November 2012, more than 220,000 children have accessed Out Patient Department (OPD) cardiology consultations, and around 23,000 have been operated on till date. With a daily OPD patient attendance of around 80-100 cases of CHD, it is expected that most of the children needing surgery will be on the waiting list for surgery for a period of 6 to 8 months or longer. Apart from detailed paediatric cardiac consultation including Echocardiography(ECHO) test, Counselling and Dietary advice are offered to the children and their parents. Majority of the patients are from lower socio-economic backgrounds and are from different parts of India. It has been repeatedly observed that a significant lack of awareness about proper nutrition for children, as well as and inappropriate Infant and Young Child Feeding (IYCF) practices, contributing to the morbidity and malnutrition of CHD children.

It is proposed that if novel methods for Intensive Nutrition Counselling are employed for this group, considerable improvement in nutritional status of the child will be observed. This will also ensure a good post-op recovery when these children are operated.

Dieticians should ideally provide personally tailored nutrition advice to parents with children of CHD. Follow-up is hampered by a lack of appropriate tools for nutrition assessment and counselling in practice settings. Smartphone technology can address the limitations of traditional methods of recording dietary intake and counselling. Feedback on these records can then be provided by the dietician via smartphone. The efficacy and validity of these methods requires examination.

Smartphone ownership in India is increasing, with around 50% of the Indian adults owning a smartphone in 2016, as reported by the Telecom Regulatory Authority of India (TRAI).[7]

There are about 650 million mobile phone users in India, and over 300 million of them have a smartphone, according to TRAI.[7]

Smartphone features such as cameras, microphones, and Internet connectivity make them an ideal mode of dietary assessment, education, and counselling. With access to appropriate technologies and training, dietary counselling advice can be relayed between clients and dieticians in real time, transcending distance, and potentially overcome barriers relating to literacy or numeracy skills. This would support the provision of dietary feedback over distance (e.g.: through telephone or video consultation), broadening the scope of dietetic services.[8]

Recent studies have recommended the development and use of new health promotion programs using smartphones and apps, including evidence-based guidelines for dietary management, improved physician-patient interaction, and improved access to services from a distance.[9]

Previous methods of smartphone based dietary assessment and counselling have been examined in healthy adult,[10-14] adolescent,[15,16] and child[17] populations, in overweight and obese adults [18], and in type 2 diabetes [19,20]. To our knowledge, no studies to date has examined the use of smartphone-based nutrition counselling for children with CHD.

In the present study, we evaluate whether a smartphone-based WhatsApp social media group can be used to educate and provide specific nutrition counselling to parents of children with CHD, resulting in improvements in child anthropometric indices.

METHODOLOGY

Study design and duration
This is a prospective interventional study with a one-group before-after study design. In this case, intervention is in the form of specialised nutrition counselling for parents of children with CHD via a WhatsApp social media group. WhatsApp Study was conducted for a period of 24 months from November 2019 to November 2021.

Ethical clearance
The study has been approved by the Institutional Ethics Committee at Sri Sathya Sai Sanjeevani Hospital, Nava Raipur, Chhattisgarh (letter no.: SSSHET/SSSSH/IEC/2019/10).

Study plan
Step 1: Recruitment of parents with children of CHD for the study
All new patients (children with CHD) visiting the OPD of our hospital for the first time were recruited for the study as per the inclusion criteria. At the time of the first OPD consultation, a 24-hour dietary history of the child was obtained along with weight,

height and other details as mentioned in the study questionnaire. The parents were given complete information regarding this study before agreeing to participate and their signed informed consent was then obtained. Detailed nutrition counselling was given to parents depending on the child's age. A social media group (WhatsApp group) was formed with investigators as moderators of the group. All parents consenting to participate in the study were added as members of the group. Children's mothers were particularly encouraged to participate in this study. If the family only had one phone, which was used by the father, and he would be away from home for the majority of the day, they were advised to share the information in the WhatsApp group with the mothers when they returned home. The WhatsApp group started functioning once 50% of the participants were recruited. At the time of recruitment in the study, all parents were explained about how the WhatsApp group would be conducted, they could post queries or doubts pertaining to their child's diet, etc.

Step 2: Start of WhatsApp group
Important Nutritional advice comprising a set menu was sent to the group for 20 days (five days a week) including recipes for energy-dense nutritious food for children (Figure 1). On the 6th day of every week i.e. Saturday, a video call was made to each parent to understand if they were following the information shared in the group, solve any concerns related to their child's diet, give individualised counselling, and get feedback from them. This cycle continued every month. Questions and concerns about feeding practices, as well as difficulties that parents faced were also addressed as needed. Parents were encouraged to maximise the benefit of this initiative by posting pictures of food prepared as per recipe shared by the group moderator and giving feedback about taste, ease of preparation, cost, etc. (Figure 2).
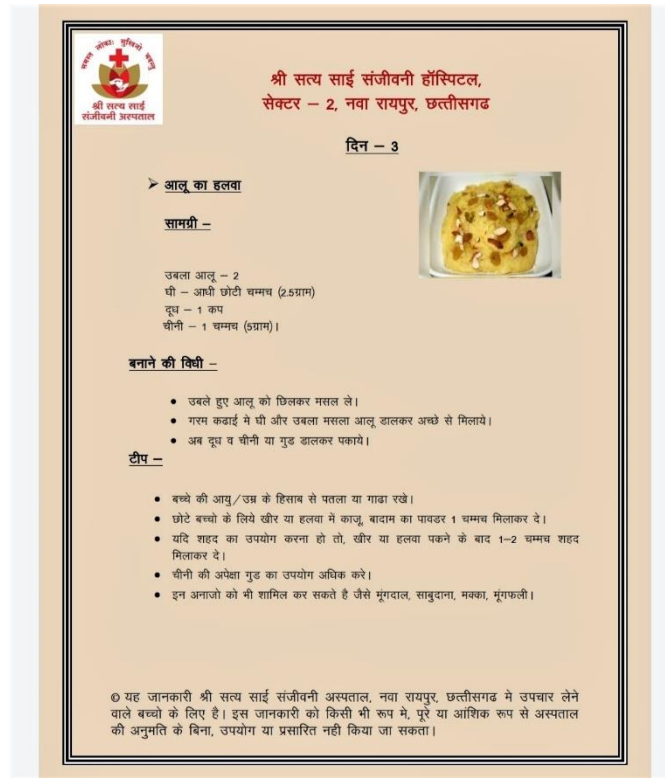

Figure 1 Example of a nutritious recipe shared in the Whatsapp group for Specialised Nutrition Counselling in local language for children's parents enrolled in the study. This recipe was shared on Day 3 of start of the Whatsapp group. Ingredients, quantity, method of preparation and extra tips for making the food more tasty and palatable for kids, is explained in detail in local language.

Figure 2 Example of a nutritious recipe shared in the Whatsapp group in local language for children's parents enrolled in the study and photograph of the prepared recipe, shared by a parent.

Inclusion criteria
Parents who had a smartphone or their father/mother/guardian had access and know how to use a smartphone, willing to participate, willing to follow dietary advice and give feedback as required. Participants agreed that they will not share the data or messages received in this WhatsApp with any other group.

Exclusion criteria
Children with critical CHD associated with complications, children with any other co-morbidity that could influence the study results, children with rheumatic heart disease, parents who did not have a smartphone or did not consent to participate in the study were excluded from the study.

Sample size
Purposive sampling was done to recruit participants. Recruitment of 60 participants was made. Six children were lost-to-follow up or dropped out, and two are still in follow-up phase and have not yet undergone surgery. This paper presented the results of 52 children.

Follow-up plan
This WhatsApp group continued for the entire study duration of two years. Fifty-two children received definitive treatment for their CHD condition at our hospital. Children were evaluated at the time of enrolment in the study during their first visit to the hospital and again when they were admitted to the

hospital for definitive treatment. If the child had any additional follow-up visit between the two visits as previously mentioned, the weight and height were recorded, but this has been excluded from the current data analysis.

Assessment plan
Detailed anthropometry was performed for all children. Anthropometric indices (z-scores) for weight-for-age, height-for-age (stunting), and weight-for-height (wasting) were calculated. Pre-intervention dietary intake was assessed at the time of enrolment in the study by 24-hours recall method. Intensive nutritional counselling was provided by trained dietician for parents of each child enrolled in the study at the time of enrolment. Follow-up assessment for anthropometric indicators and changes in dietary practices were studied after one year when the child was admitted in hospital for definitive treatment. United Nations Children's Fund (UNICEF) and World Health Organization (WHO) recommend that children aged 6 months to 2 years should eat a minimum of five to eight food groups (Breastmilk, grains, legumes, Vitamin A rich fruits & vegetables, dairy, flesh foods, other fruits & vegetables, eggs).[21] The number of food groups included in the child's diet before and after intervention were also noted. Efficacy of the intervention in context with this study is defined as whether the intervention in the form of nutritional counselling through WhatsApp group is able to

bring improvement in weight and height of the child and improves diversity in the child's daily diet.

Data analysis
Data collected for the research study was directly entered into Google forms designed for this study. This data was exported to MS Excel. Statistical Package for Social Sciences (SPSS) version 21.0 was used for data analysis. Descriptive analysis of each of the demographic variables was conducted. Paired t-test was used to assess the significance and determine changes in the child's nutritional status (z-score for weight-for-age, height-for-age, and weight-for-height) before and after intervention through the WhatsApp group.

Calculation of anthropometric indicators before and after intervention
WHO AnthroPlus Software[22] was used for assessing z-scores of nutritional indicators such as undernutrition, stunting and wasting. This software analyses anthropometric indicators based on the WHO Child Growth Standards (2007)[23] for children in the age group of 0–19 years and it is widely used as a universal standard across the world for children's nutritional assessment.[24]

RESULT
Out of the 60 children included in this study, six children were lost-to-follow up or dropped out of the study, two are still in follow-up phase and have not yet undergone surgery. The findings of 52 children were presented in this study.

Socio-demographic details of study participants
As depicted in Table 1, 27 (52.2%) were male patients and 25 (47.8%) were female patients. One third of the patients 16 (30.0%) were in the age group of 7-12 months, followed by 12 (22.5%) in the age group of 0-6 months. The mean age was 35 months, ranging from 21 days to 8 years. Chhattisgarh state contributed maximum patients (25.0%) and those from nearby districts, followed by 22.7% patients from Madhya Pradesh state. Majority of the patients belonged to rural areas i.e. 33 (63.1%) and more than half of the patients 30 (57.6%) belonged to joint families. The predominant diagnosis (48.9%) was Ventricular Septal Defect (VSD), followed by 14 (26.7%) children with Atrial Septal Defect (ASD), Patent Ductus Arteriosus(PDA), Tetralogy of Fallot(TOF), Transposition of Great Arteries(TGA) were 3(6.7%) cases each,etc. About 33.3%(18) of the children's mothers had completed their higher secondary education, 12.5% (7) were graduates, 19.2% ((10) had finished their secondary education. 40.0% (21) of the fathers of the children enrolled in the study had completed their higher secondary education, 28.8% (15) were graduates, 15.4% (8) had finished their secondary education. 30.0% of the children's fathers were farmers or unskilled labourers. Socio-economic class was assessed using the Modified Kuppuswamy classification[25] wherein 36 (68.8%) patient-families were identified as lower socio-economic class.

Table 1 Characteristics of children with CHD and their families (n=52) enrolled in the study

Characteristics	No. Percentage	Characteristics	No. Percentage
Age (in months)		State	
0-6	12 (22.5%)	Chhattisgarh	13 (25.0%)
7-12	16 (30.0%)	Madhya Pradesh	12 (22.7%)
13-24	7 (12.5%)	Maharashtra	9 (18.2%)
25-48	2 (5.0%)	Bihar	6 (11.4%)
49-60	7 (12.5%)	Uttar Pradesh	6 (11.4%)
>5years	9 (17.5%)	Others	6 (11.3%)
Gender		Educational status of mother	
Male	27 (52.2%)	Primary (1-5)	5 (9.6%)
Female	25 (47.8%)	Middle (6-8)	5 (9.6%)
Area of residence		Secondary (9-10)	10 (19.2%)
Urban	29 (36.7%)	Higher secondary (11-12)	18 (34.6%)
Rural	33 (63.3%)	Diploma/ Certificate course	3 (5.8%)
Diagnosis		Graduate	7 (12.5%)
VSD	25 (48.9%)	Post graduate	4 (7.7%)
ASD	14 (26.7%)	Type of family	
PDA, TOF, TGA	3 (6.7%) each	Nuclear	22 (42.3%)
Other CHD cases	4 (7.7%)	Joint	30 (57.7%)
Socio-economic class (based on Modified Kuppuswamy scale 2019 for Socio-economic classification for India) [7]		Father's occupation	
Upper	2 (4.5%)	Unskilled (labourers, housekeeping, etc.)	20 (38.5%)
Upper Middle	6 (12.1%)	Skilled (welder, tailor, mechanics, etc.)	12 (23.1%)

Lower Middle	8 (14.5%)	Professional (teacher, police, engineer, etc)	5 (9.6%)
Upper Lower	21 (40.3%)	Business	6 (11.5%))
Lower Lower	15 (28.5%)	Others	9 (17.3%)

Anthropometric assessment parameters before intervention

Average study duration was 18 months (range: 12 to 24 months), depending on when the children underwent surgery. Malnutrition was assessed based on three indicators, namely underweight, stunting, and wasting, and it was found that a significant proportion of children had malnutrition. Out of the 52 children enrolled in the study, the majority i.e. 71.1% of children (37) were found to be underweight, with the mean z-score of -2.51, SD 1.26. Of these, 29.0% (15) children were severely underweight (z-score below -3.0 S.D.) and 42.1% (22) were moderately underweight. No child was overweight or obese. The age group with the predominant underweight status was 7-12 months where 9 out of 16 children in this age group (62.5%) were severely underweight followed by children of the age group 13-24 months (33.3% were severely underweight).

Considering the indicator of stunting (z-score for height-for-age <-2.0 SD), out of the 52 children enrolled in the study, 35.5% (18 of 52) were found to be stunted, with the mean height-for-age z-score of -1.13, SD 1.6. Of these, 3 children were severely stunted (z-score below -3.0 S.D.) and 15 were moderately underweight. The age group with predominant stunting was 7-12 months, where 8 out of 16 children in this age group (50.0%) were stunted.

Considering the indicator of wasting (z-score for height-for-age <-2.0 SD), out of the 52 children enrolled in the study, 65.6% (34 of 52) were found to be wasted, with the mean weight-for-height z-score of -2.47, SD 1.24. Of these, 40.6% (21 children) were severely underweight (z-score below -3.0 SD) and 25.0% (13 children) were moderately underweight. The age group with predominant wasting was 7-12 months, where 14 out of 16 children in this age group (87.5%) were stunted, followed by children in the age group 13-24 months (83.3% were stunted).

Malnutrition was found to be slightly more common in boys compared to girls. This was observed for all the 3 indicators. 86.0% of boys were underweight, whereas 56.3% of girls were underweight. 40.0% of boys were stunted compared to 31.3% of girls, and 71.4% of boys had wasting compared to 61.1% of girls. The difference, however, was not statistically significant (Pearson Chi-square value for stunting z-score: 12.572, df = 2, P = 0.127).

Anthropometric assessment parameters after intervention

Post-intervention, the children's nutritional status was assessed using the same anthropometric indicators, namely underweight, stunting, and wasting. Each child and parent enrolled in the study received the intervention for a minimum of 12 months. Post-intervention, follow up height and weight were measured to assess the impact of the intervention (Specialised Nutrition Counselling through WhatsApp group) when the child was admitted to the hospital for definitive treatment (surgery) of CHD.

There was a significant improvement in the weight and height of children. As shown in Figure 3, 36.0% of the 52 children enrolled in the study were found to be underweight after intervention, with a mean z-score of -1.77, SD 1.15, compared to 71.1% of children who were underweight before intervention, with a mean z-score of -2.51, SD 1.26. A paired t-test was used to assess significance. As shown in Table 2, the difference was found to be significant (t = 3.23, p = 0.003), with a 95% confidence interval (-3.89, 0.35). Average weight gain in this group was 6.2 kg (ranging from 2 to 12.5 kg) as depicted in Figure 3. Stunting decrease from 35.5% before intervention compared to 21.7% after intervention. Wasting decrease from 65.6% before intervention to 45.5% after intervention.
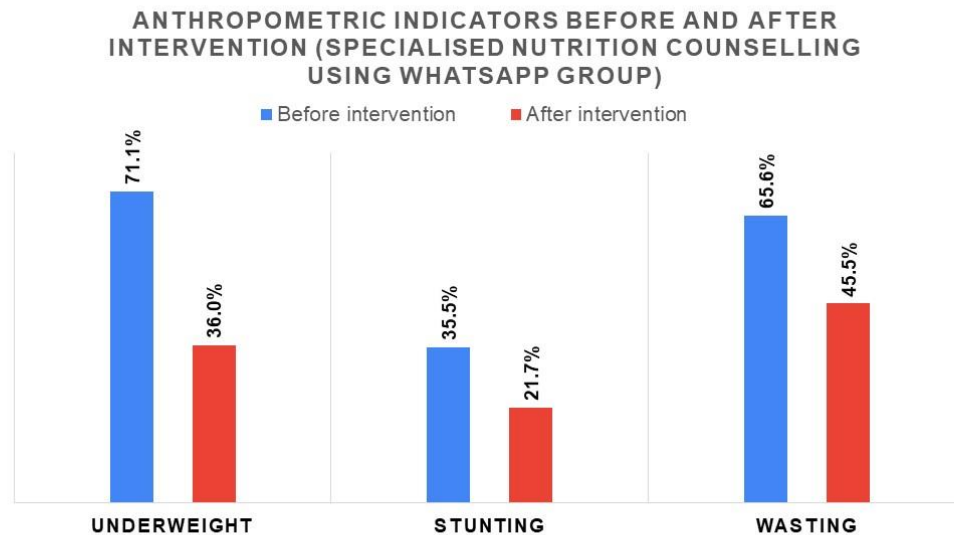
Figure 3 Anthropometric indicators before and after intervention (Specialised Nutrition Counselling using Whatsapp group). There is significant reduction in all 3 nutritional indicators post intervention.

Table 2 Paired 't'-test to assess significance before and after intervention

| | Mean | SD | Std. Error Mean | 95.0% CI of the difference | | t | df | P value: Sig (2-tailed) |
				Lower	Upper			
Weight-for-age z-score before intervention (Specialized Nutrition Counselling) through Whatsapp group	-2.51	1.26						
Weight-for-age z-score after intervention (Specialized Nutrition Counselling) through Whatsapp group	-1.77	1.15	0.831	-3.89	0.35	-2.473	51	0.003

Paired t-test (t=3.23), difference was found to be significant (p=0.003), the 95.0% confidence interval for the difference is (-3.89, 0.35).

The parents noticed a change in their child's food preferences after participating in this WhatsApp group. Specialised nutrition counselling and the daily sharing of set menus and recipes in the group helped to positively engaging the parent's interest in their child's feeding habits. Earlier, only 2-3 food groups were consumed on a daily basis by the children, however, after counselling and participation in this group, all parents included the 8 food groups in their children's diet thus providing them with wholesome nutrition.

Dietary assessment before and after intervention

At the time of the study, a 24-hours dietary history of the child was obtained to assess calorie and protein intake for each child. Age and gender-specific data analyses were conducted to determine the research participants' calorie and protein intake as well as any deficits because each age sub-group and gender has a distinct daily Recommended Dietary Allowance (RDA).[26] Average calorie intake was 578 calories (cal) for children 7 months to 1 year and protein intake was 9.57 g. According to RDA for the age group of 7–12 months, calorie intake should be 672 cal and protein intake should be 14.0 g. Here, in this study group, calorie deficit was 94.0

cal and 4.43 g. As depicted in Figure 4, the average calorie intake in the age group of 7–12 months improved to 617 cal and the average protein intake increased to 14.0 g. The average calorie intake for children aged 1 to 5 was 978.0 cal and 18.0 g protein. In this age group, calorie intake should be 1060 cal and protein intake should be 22.0 g. In this case, the deficit was 94.0 cal and 4.0 g protein. As shown in Figure 4, the average calorie intake in the age group of 1-5 years improved to 1030 cal and average protein intake increased to 20.0 g.

CALORIE AND PROTEIN INTAKE BEFORE & AFTER INTERVENTION (n=52)
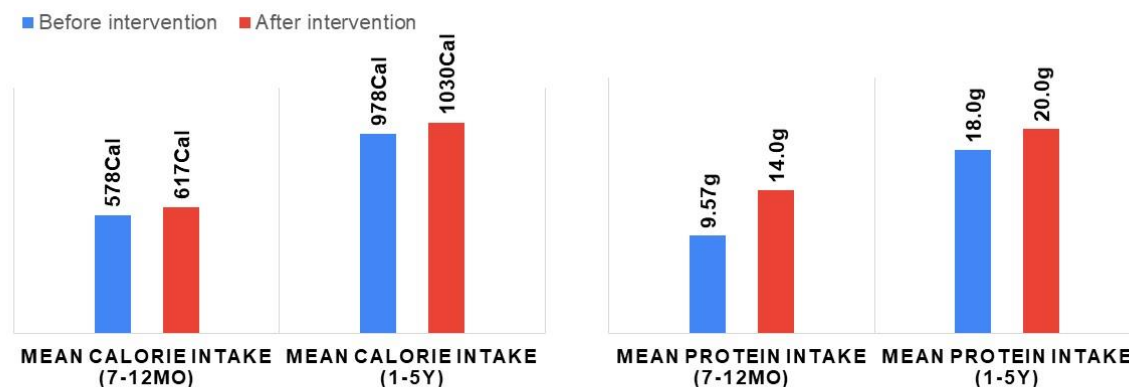

Figure 4 Calorie and Protein Intake Before & After Intervention (N=52). There is increase in the average calorie and protein intake in age groups 7-12months and 1-5years post intervention.

DISCUSSION

This is the first study to look at the use of a WhatsApp social media group for: (1) intensive specialised nutrition counselling for parents of children with CHD and (2) changes in anthropometric growth parameters before and after intervention. Parents gave feedback that this group served as a great support to them especially during the first wave of the unprecedented COVID-19 pandemic, where they could not come for routine follow-up to the hospital due to travel restrictions. The dietary counselling that they received from the group was a big boon to them during this time. The daily sharing of recipes and addressing their concerns, as well as weekly videocalls by dietician boosted their confidence in tackling nutrition related challenges, especially for the first-time parents whose had only child with CHD in the study.

Children with CHD may experience poor weight gain and linear growth (malnutrition) due to several factors like increased work of breathing, and increased energy demand, while at the same time decreasing overall calorie intake.[27] These children need caloric supplementation before and after surgical or medical management of their cardiac condition to achieve catch up growth. Hence, through this WhatsApp group, parents were trained and guided to make small changes in their child's diet involving caloric and protein supplementation, to improve the child's weight before surgery for better surgical outcomes and post-op recovery. The pre-operative period may be considered a good time to optimise the nutritional status, especially to act upon modifiable risk factors and potentially lower the risk of intra-operative and post-operative complications arising from malnutrition.[27]

Almost equal number of boys (27) and girls (25) patients were enrolled in the study. Majority of the patients 16 (30.0%) were in the age group of 7-12 months, followed by 12 (22.5%) in the age group of 0-6 months. This patient profile was similar to that observed routinely in outpatient consultations of other pediatric cardiac hospitals.

Majority of the children's mothers were educated. This was important for the study so that parents and especially mothers would be able to use WhatsApp on their phone and follow the daily dietary messages/ recipes shared on the group to ensure maximum participation and benefit of each child-family. 30.0% of the children's fathers were farmers or unskilled labourers. Socio-economic class was assessed using the Modified Kuppuswamy classification wherein 36 (68.8%) patient-families were identified as lower socio-economic class, indicating that this intervention included

underprivileged sections of the society, which was the initial concept of this study.

Before intervention, majority i.e. 71.1% of children (37 of 52) were found to be underweight. Post-intervention, there was improvement in weight of 50.0% of children included in the study. The difference was found to be significant (t=3.23, p=0.003), the 95.0% confidence interval for the difference is (-3.89, 0.35), depicted in Table 2. Average weight gain in this group was 6.2 kg (ranged 2 to 12.5kg). Stunting reduced to 21.7% post intervention compared to 35.5% before intervention. Wasting reduced to 45.5% post intervention compared to 65.6% before intervention. Use of WhatsApp based social media group was found beneficial by Prime et al [28] wherein the major study finding was that the application of android-based nutrition education media was able to improve attitudes, knowledge, and practices of balanced nutrition in children.

Malnutrition was predominantly observed in the age group of 7-12 months before intervention wherein all 3 anthropometric parameters were low. On dietary evaluation for calorie and protein intake, maximum deficit was also pronounced in this age group. It was observed that faulty feeding practices during this most important phase of child growth and development hampered the growth in these vulnerable children who were already compromised due to their cardiac defect. Other investigators[29-30] had also noted high prevalence of stunting and underweight in both affluent and underprivileged settings. Parents had misconception that child was bound to be malnourished due to his heart defect but had not given enough thought or effort on maximising proper infant and young child feeding practices.[29] 60.0% parents of children in 7-12 months' age group were aware that complementary feeding should begin once the child completes six months of age but had not initiated top feeding to their infants, due to multiple reasons. This was also observed by other authors, report by George et al[31] summarised that timely introduced foods for children between 6 and 8 months of age was 53.8% and only 10.9% of children (between 6 and 23 months of age) received an adequate diet.

This intervention particularly helped to improve infant and young child feeding habits for the age group of 7-12 months and children above 2 years. Post-intervention resulted all parents to include the 8 food groups in their children's diet thus providing them with wholesome nutrition whereas pre-intervention period only provided 2-3 food groups on a daily basis by the children. This was also observed by Anjana P et al[32] wherein timely initiation of complementary foods was seen only in 34.5%, breastfeeding continued in 47.3% beyond 6 months, 53.6% did not satisfy the minimum meal frequency and 86.4% did not satisfy the dietary diversity, 49.0% children were underweight.

Thus, WhatsApp social media group is an effective tool for intensive specialized nutrition counselling for parents and changing anthropometric growth parameters in children was observed before and after intervention. This group gave them an opportunity to learn from each other and shared their experiences.

CONCLUSION

With over 50% of households owning mobile phones (Telecom Regulatory Authority of India, 2016) and most of the health providers have access to them, the potential of extending mobile technology-based counselling to rural areas is worth exploring. This is the first study to explore the impact of a smartphone-based WhatsApp social media group that can be used to educate and provide specific nutrition counselling to parents of children with CHD resulting in improvement in child anthropometric indices. Post-intervention resulted improvement in all 3 indicators of malnutrition (underweight, stunting, wasting) with average weight gain of 6.2 kg in the group. This intervention particularly helped improve infant and young child feeding habits for the age group of 7-12 months and children above 2 years. Post-intervention resulted all parents to include the 8 food groups in their children's diet thus providing them with wholesome nutrition whereas earlier only 2-3 food groups were consumed on a daily basis by the children. Thus, it can be concluded that this study can be replicated in varied populations for educating parents about the appropriate Infant and Young Child Feeding Practices (IYCF).

Limitation

The study was conducted only among those patient families that had access to a phone with WhatsApp smartphone-based application. There is a possibility that poor families with no access to a smartphone cannot been included due to the inclusion criteria of this research project.

Ethical clearance: The study has been approved by the Institutional Ethics Committee at Sri Sathya Sai Sanjeevani Hospital, Nava Raipur, Chhattisgarh (letter no.: SSSHET/SSSSH/IEC/2019/10).

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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