

School-Based Nutritional and Water, Sanitation, and Hygiene Education Intervention to address  
Malnutrition of Early Adolescents in Gojra Pakistan

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## Summary

Globally, one of the major risk factors for adolescent morbidity is considered Malnutrition. Worldwide adolescent age group 10-19 is increasing and they are at increased risk of malnutrition-related diseases resulting in high morbidity and mortality. Asian countries are suffering from the double burden of malnutrition including Pakistan. The risk factors that contribute to malnutrition in the population include unsafe drinking water, poor sanitary conditions, lack of proper waste disposal facilities, poor health awareness, and poor nutrition and hygiene. However, studies have shown that nutrition education, and water, sanitation, and hygiene (WASH) programs in schools are effective strategies to promote the health status of adolescents (girls and boys). The primary objective of this study is to determine a school-based nutrition and WASH education intervention to improve nutritional status among early adolescents. The randomized control trial (RCT) study design will be chosen for this study. This study will be carried out in Gojra public schools, in Punjab. The study participants will be 6-8 grade school-going adolescents (girls and boys), their mothers/immediate caretakers, and school teachers. The data collection methods that will be used for the study are surveys, focus group discussions (FGDs), and through observation. Anthropometric measurements and specified micronutrient levels of adolescents will be measured at baseline and end line. The intervention will consist of skill-based nutrition and WASH education for the adolescents along with deworming and micronutrient supplementation. Workshops based on nutrition and WASH will be arranged for school teachers. This study will be carried out over one year with two-time data collection (baseline, and end line). Data will be analyzed by using SPSS and transcription. The expected outcome of the study would be that the implementation of identified nutrition and WASH strategy is effective to generalize in the poor nutritional status population in schools. It will show the promising benefit of education and WASH intervention, in reducing the cases of

early adolescent malnutrition. Through the findings of the study, we can bring the revolution at the micro-level targeting the community to modify the curriculum of this age group.

## Introduction

Malnourishment is one of the grave public health issues and a significant cause of high morbidity and mortality among young Pakistani children. Several factors determine the high prevalence of malnutrition, which includes unsafe drinking water, poor sanitary conditions, lack of proper waste disposal facilities, poor health awareness, and poor nutrition and hygiene (Hirani, 2012). According to a report by the World Health Organization (WHO) published in 2017, malnutrition was categorized into three broad groups; “**undernutrition** (wasting, stunting, and underweight), **micronutrient related malnutrition** (deficiency or excess of micronutrients), **overweight, obesity and diet-related non-communicable diseases**” (Dat, 2018). According to another report by WHO, which was based on anthropometry, nutrition was classified as under and over-nutrition. According to this classification, **undernutrition** is divided into thinness, stunting, and underweight, while **overnutrition** is grouped into overweight and obesity. This classification of malnutrition was for children over five and adolescents. (De Onis, 2015).

At present, adolescents constitute the major proportion of all the age groups worldwide and 1.8 billion of the total world population consists of adolescents (between 10-19 years of age). Out of these, approximately 90 percent belong to Low and Middle-Income countries (LMICs) (Patton & Kabir, 201, Christian, 2018). The adolescent population was further divided into early and late adolescent by United Nations, the early adolescents age range between 10–14 years, and the late adolescents age group range between 15– 19 years (Christian, 2018).

In 2015, about 1.2 million adolescent deaths occurred globally (WHO,2017), 26 % of them in the South East Asian Region (WHO,2016). The leading causes of death in early adolescents include diarrheal diseases, intestinal infections and respiratory tract infections, and road traffic accidents (Dick, 2015). Malnutrition is the major contributing factor coupled with other causes of adolescent death (Reiner,2019). Globally, the main nutritional issues affecting

adolescents are undernutrition, anemia, and micronutrient deficiencies (Iron, Vitamin A, Zinc, and iodine,) (Shahid, 2009). Around 1.2 million adolescents in developing countries face serious nutritional challenges (Hossain, 2017 & Akhter, 2013).

According to the 2018 National Nutritional Survey (NNS) in Pakistan, adolescent (10-19 years) boys are more affected than girls in terms of being underweight, and more adolescent girls are overweight compared to their male peers. The prevalence of malnutrition across Pakistan varies from one region to the other. All provinces have different rates of malnutrition, the underweight population in Sindh province is higher as compared to other provinces, while the prevalence of obesity on the other hand is high in Baluchistan and KP provinces of Pakistan along with NMD (newly merged districts). In Punjab province, more adolescent boys are underweight than girls.

Survey also showed that 56.6 % of adolescent girls in Pakistan are anemic (NIPS & ICF 2019).

All over Pakistan, the high prevalence of both underweight and overweight/ obese adolescent populations is a major concern and requires serious attention to addressing all forms of malnutrition-associated disorders. According to a report, micronutrient deficiencies and malnutrition were observed in young women between the ages of 15-19 years and children under five years of age. However, the early adolescent female group and males aged between 10- 19 years were not studied in this group for micronutrient assessment, although this age group is 23 % of Pakistan's total population. The early adolescent group (age 10-14 years) consists of almost 12 % of the total population of Pakistan (NIPS & ICF 2019).

The physical and mental growth and learning abilities of adolescents are influenced by many factors. These factors include the health condition of the adolescents and their perception of their health practices, school environment, socio-economic status of their parents, and nearby facilities of health services. The most important factor influencing the health, mental growth, and

educational performance among adolescents is their nutrition status (Mwaniki, 2014 & Madjdian, 2018). Healthy Nutrition results in better growth and development during infancy and adolescents. However, nutritional requirements keep changing through the period of adolescence (Zulfiqar, 2017). Almost 80 % of adolescent's growth is completed in the early adolescence phase and is associated with emotional, cognitive, and hormonal changes (WHO, 2006). Adolescents attain 50 % of their physical growth during the early adolescent period (Hossen, 2016). Their caloric requirements also reach up to 2000-3000 Kcal per day for males, while for females the requirement is 2000-2500 Kcal along with an increase in protein intake requirement of 1.1-1.2 g/kg/day (Paracha,2019). The dietary requirements of both early as well as late adolescent groups are almost the same as well as macro and micronutrients are concerned (WHO, 2006).

The study conducted in Sialkot in 2013 on three hundred twenty-eight school going adolescences of both genders revealed that the diet and nutritional status were not up to the standards of adequacy for micro nutrients (minerals), and females are more affected than males (Rifat-uz-Zaman, 2013). An increase in physical activity along with deprived eating practices and other issues like menstruation highlight the possible risk factor for adolescent's poor nutrition. The results of the research studies conclude that malnutrition leads to deprived physical and mental development, poor resistance to diseases and poor performance at school (Bhutta, 2011 & Haddad, 2015& Bundy, 2018). In addition, adolescent girls' requirement for iron intake increases due to menstrual blood loss. On the other hand, boys have increased iron intake requirement due to muscle mass accumulation along with an increase intake of calcium as the majority of the skeletal growth taking place in this period (Bundy, 2017).

Iron deficiency and anemia lead to decrease or slow cognitive functioning, lower educational achievement, and lower physical capability. Iodine deficiency causes harmful effects

like neural impairment and culminates in poor educational achievements. For healthy immune system functioning and optimal vision, Vitamin A is important. A low level of Vitamin A can negatively affect physical growth and sexual maturation. Zinc is also vital for attaining maximum growth potential (World Bank, 2003).

Other contributory factors of malnutrition include contaminated water, worm infestation, poor personal hygiene practices, and unsatisfactory sanitary conditions (United States Agency International Development USAID, 2015; WHO, 2004). In adolescents, infectious diseases are one of the causes of malnutrition and according to a report by WHO, 88 % of infectious diseases are a result of poor sanitary conditions and poor hygiene habits coupled with unsafe drinking water (WHO, 2004 & 2008a). Poor sanitary, and hygiene conditions and unsafe drinking water resulted in water borne diseases like diarrhea, which in turn contribute to malnutrition. Along with this, diarrhea contributes to absenteeism among school-going adolescents particularly in Pakistan 34 % of girls compared to 40% of boys 10-14 years are out of school (Centers for diseases control and Prevention, 2014 & GAIN,2018). However, it is evident that wherever sanitation facilities improve, accordingly the enrollment rate of girls in those institutions automatically increased. According to WHO data, due to the availability of sanitation facilities, only 11 % more girls attend school (Njau, 2016).

In addition to UNICEF Report 2008, children with worm infestation showed poor performance in cognitive capabilities, and academic achievements that increase absenteeism from school as compared to their healthy peers (Njau, 2016). The highest burden of worm infestation in young school children aged 5-15 years due to poor sanitation and hygiene (Luong, 2003). Study conducted by WHO in Asia and Africa revealed that deworming has improved stunted growth, cognitive performance, and anemia level (Olds,2013). By reducing the pathogen load and disease burden of infectious diseases like worm infestation, diarrhea,

WASH (water, sanitation, and hygiene) intervention results in better nutritional status (Dodos, 2017). Interventions on water sanitation, hygiene, and actions on nutrition has shown positive nutritional outcomes (USAID, 2015, Tamiru, 2017).

United Nations Agency (UNICEF) in 2013 emphasized that community-based nutrition program for adolescents should be conducted, that include school based biannual deworming, behavioral change communication, promoting girl's education and also encourage nutrition, hygiene, and sanitation practices. In addition, the promotion of nutrition action through teachers, parent-teacher associations, and the incorporation of nutrition into the school's curriculum. Furthermore, the promotion of the use of iodized salt and micronutrient supplementation was recommended (Gilbert, 2013).

The results of the 13 randomized controlled trials based on multi-strategy intervention (including nutrition education and health of adolescents) from 2000 -2014 revealed that multi-strategy school-based nutrition programs resulted in good physical and mental growth of the adolescents when facilitated by teachers and parents, with adjustment in the school environment (Meiklejohn, 2016). Results of similar studies conducted in China revealed that a large number of students after nutrition education intervention in schools had better knowledge about the nutritional value of different food products than the control group (Wang, 2015). Another study finding showed that the prevalence of child malnutrition through planned nutrition education program in schools was reduced. The researcher found it a scientific, logical, and cost-effective strategy (Pateel, 2015).

Early adolescents (ages 10-14 years) are generally overlooked, as they are comparatively hard to reach, which in turn results to ignore the needs of adolescent girls and boys in this group. Early adolescents are a distinctive phase of life because it is a time of maximum physical and mental growth (Shahid, 2009). It was found that adolescent of this age group was not given due



importance and the focus remain on under five and lactating, pregnant women (LPW) age group. (Best 2010). The studies in Pakistan generally focused on physical status of children like weight and height in the age groups of 5-15 years. There is the poor outcome of nutritional status and WASH practices of early adolescent (10-14 years age) girls and boys, which formulates 12 % of the total population in Pakistan (Hirani, 2012 & NNS 2018).

Many researches and systematic reviews have been conducted in perspective of the nutritional status of under-five and lactating and pregnant adolescents by Aga Khan University Karachi (Bhutta, 2013,2016 & Salam,2016). However, very few researches have been conducted in Pakistan to assess the nutritional status of early adolescents (Fatime,2016 & Ahmed,2016, Ishaque, 2012). According to researcher knowledge, there is no study available on nutrition education with h integration of WASH components in early adolescents. The Government has ignored this fact usually, as there is a dire need to focus on the nutrition and WASH education of adolescent girls and boys through educational institutions in order to prevent future adverse outcomes (Fatima.2014). Therefore, the schools are the best setting to catchup this population and the implementation of the intervention strategies. In school-based health education, a conducive classroom environment plays an important role for adolescents to learn content and life skills. It also provides an opportunity for interactive discussions, to plan and practice community activities, and to reflect on those activities (Bhutta, 2015). Furthermore, school-going adolescents can also become a change agent for siblings, parents, and at community level. Studies have shown that the most common school health strategies for health education intervention focused on curriculum, school values, and beliefs, general environment, and focused on parent and community networks (Wang, 2013). The present study will focus on nutritional status with the integration of WASH practices of early adolescents. This study will be divided into three phases such as formative, RCT, and dissemination phase.

1. In the formative phase of the study focus group discussion with the early adolescents, their mothers/immediate caretakers, and school teachers to explore the perception regarding healthy diet and WASH practices. Key informant interviews will also be conducted with school management to explore the insight regarding enablers and barriers for the implementation of the school-based strategies.
2. In the RCT phase, baseline assessment of the school-going adolescents will be conducted (knowledge, attitude, and practices (KAP) regarding healthy diet and WASH practices, along with biochemical markers (Blood complete picture, Zinc, Calcium, and Vitamin D level) in subset of 180 participants from total adolescent's target study population. Furthermore, intervention focusing multi components strategies like nutrition education, deworming, Water, Sanitation, and Hygiene will be implemented for 6, 7, and 8 grade school going early adolescents. For the Adolescents mothers/Immediate care taker cooking recipe books will be provided in the local context based on Pakistan dietary guidelines. Workshop will be arranged for school teachers to train them as master trainer. In the end line of the study, KAP evaluation and biochemical, markers will be done to assess the effectiveness of the intervention.
3. Dissemination phase or research uptake

Pakistan has significantly high incidence of malnutrition, which needs to be explored and addressed in early adolescents. Poor nutritional status in children leads to lot of physical and mental problems during this phase of life and afterword. Healthy Nutrition result in better growth and development during this period and is a second window of opportunity for catch up growth who have already experienced stunting (Bundy,2018 & WHO,2014). According to Hossen, “well-nourished adolescents at present can make optimal use of their skills, talents, and energies and be healthy, responsible citizens and parents of healthy babies” (Bhutta,2014 & Hossen,

2016). Hence, for their physical and mental development a good nutrition has a major role to play (Bundy et al., 2018).

Therefore, this study is designed to assess the effect of Nutrition education and water, sanitation, and hygiene intervention on school going early adolescent girls and boys in Gojra, Pakistan and to suggest ways how to overcome this health issue.

### **Significance of the study**

The agenda of the United Nations' sustainable development goals (SDG) 2030 is to promote the person with disabilities. Specifically, SDG 3,4,5,6 aimed to achieve good health and wellbeing (end of communicable diseases), quality education (secondary education and conducive learning environment), gender equality (empowerment), and clean water and sanitation (safe and affordable drinking water, sanitation and hygiene especially to girls) of the target population (United Nations ,2016). This project significantly contributes to decreasing the prevalence of malnutrition among school adolescents that will contribute towards partially achievement of SGD,3,4,5 and,6.

This study will help address malnutrition in school-going adolescents. The prevalence of malnutrition is maximum at the adolescent age as it is the most rapidly growing age in both genders. Adolescence is the most important, rapid, and formative phase of human development with unique physical, cognitive, social, and emotional changes taking place. National policies and programs should incorporate the nutritional consequences of this phase of life. The effect of the water, sanitation, and hygiene interventions on nutritional status can better be studied in the adolescent (boys and girls) stage. Another important aspect is that adolescence is a transition from childhood to adulthood, which carries both types of habits along. During preparation for the new demands of adult life, the brain often undergoes complex rewiring processes. With this viewpoint, it can be readily understood that adolescence is a very unique age with additional

dietary requirements to meet the needs of the growth spurt and with the potential to have a significant impact on reproductive health and work, which will in effect affect future generations (Bhutta,2014).

Adolescence is the making or breaking stage of life. Major physical, mental, and psychological growth takes place at this age. Adequate and balanced nutrition is a vital requirement to support this phase. A good nutritional knowledge regarding balance diet for adolescence goes a long way in improving the overall health and producing healthy responsible adults (Bundy,2017).

Adolescents can contribute health of not only themselves but of their families and communities as a whole. The adaptive capabilities of adolescents make them more experimental, exploratory, and risk-taking, which in turn makes this age very appropriate to carry the studies which ultimately improve all aspects of their lives (Dick,2015).

The findings of this study will evaluate the knowledge, attitude, and practices of school adolescents regarding nutrition and WASH. Previous studies have focused on the nutrition intervention of under 5 years of age children or lactating and pregnant women; However, the present study will focus on multicomponent (nutrition, WASH, and deworming) intervention for school-going adolescents. This will be the first kind of its study conducted in a Pakistan setting. The results of this study will serve as a valuable guide for school management and health educators to plan suitable nutrition and health programs. This study will also offer recommendations for school management to adopt similar interventions for nutrition and WASH technique. This will also help them to repeat the same program for other target groups at school or community level. It will also encourage government and other stakeholders for the development of programs and policies related to nutrition and health at schools, districts and province levels. The present study will also add new knowledge to existing practices regarding nutrition and health of adolescents group.

## **Philosophical underpinning**

The study will be guided by the post-positivist paradigm. This paradigm has tended to provide the worldview for most research conducted on human behavior typical of the education context (Kivunja, 2017). Research in this mode requires an ability to see the whole picture, to take a distanced view or an overview. This paradigm allows for observation without experimentation and formulation of hypotheses to be tested.

For clarity purposes, this study will be divided into three phases. Phase I is the formative phase for the development of the intervention module. Phase II is the RCT phase in which the baseline assessment and intervention module will be implemented through the teachers and researcher along with the end-line assessment. Phase III will be research uptake. According to Guba (1990) in post-positivism, reality can never be fully understood but at best only approximated. Data, evidence, and rational considerations shape knowledge. The researcher will collect information on instruments based on measures completed by the participants or by observations recorded by the researcher. Being objective is an essential aspect of competent inquiry; the researcher will examine methods and conclusions for bias like the standard of reliability and validity.

## **Framework**

For this study, a socio-ecological approach will be adopted because to change the behaviors of individuals permanently, changes in the environment has to take place (Wang, 2016). Based on the work of Urie Brofenbrenner, Lori Heise & McLeory in 1998 offered a theory-based framework for understanding the multi-layered and interactive effects of personal and environmental factors that determine behaviors such as smoking, physical activity, nutrition, sexual activity, and intermediate health promotion. This framework consists of five levels that are used in different setting at different levels. These levels include **intrapersonal**,

**Interpersonal, Institution, Community, and Policy. (Fig 1).** Regardless of topic, setting, and time period, most of the studies describe intrapersonal or interpersonal level activities with easily measurable objectives, while community and policy level activities are much less due to training of the health educators or resources to plan and implement institution, community, or policy level programs. However, few studies showed school-based intervention used three or more levels. (Level, 2002 & Golden, 2012). Furthermore, this model not only influence the health behavior of the target population, but also for the execution of health/ nutrition education, and WASH practices (Golden, 2012.) Therefore, this study will use the school health environment, school nutrition and WASH program, and family and community involvement based on the socio-ecological model to design the intervention at all levels.

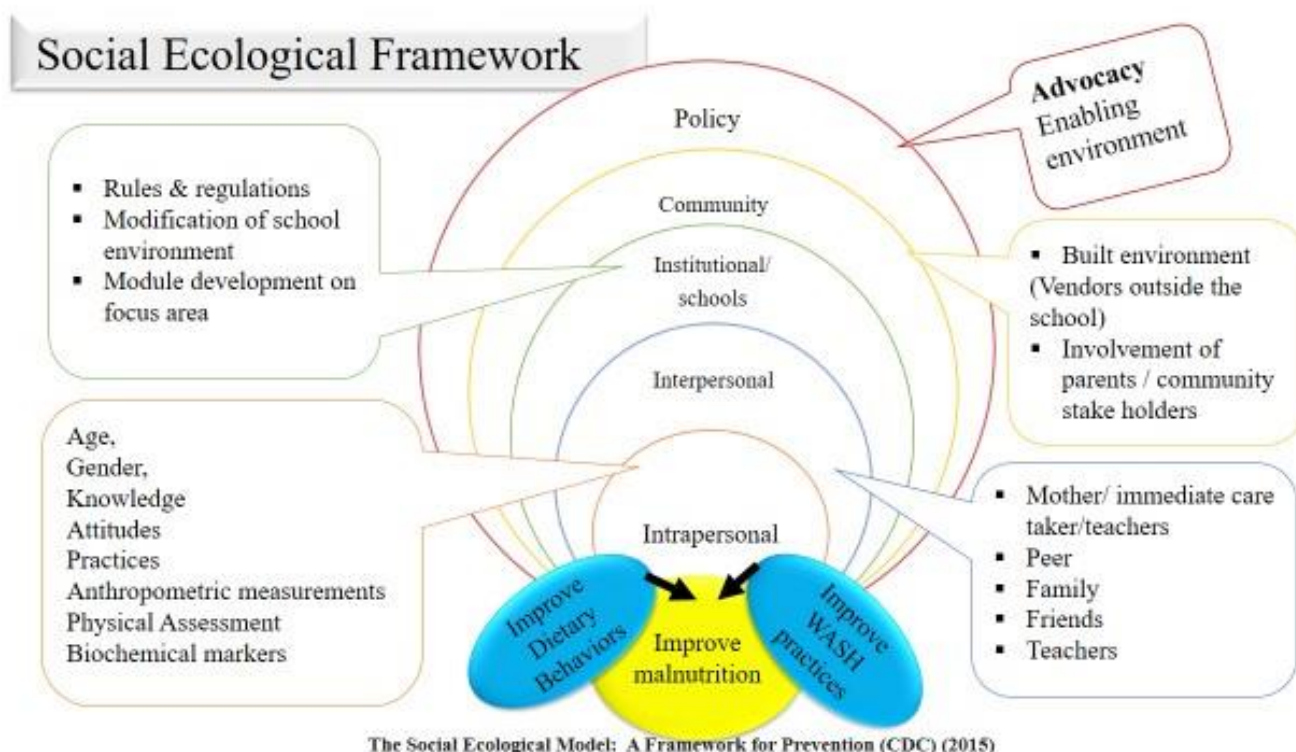
**Intrapersonal:** At intrapersonal level knowledge, attitude, and practice regarding nutrition and WASH will be assessed. Skill-based education will be provided to the adolescents regarding healthy diet and WASH. Furthermore, monitoring of micronutrient levels and, deworming will be carried out.

**Interpersonal:** At the interpersonal level, involvement of mothers/immediate caretaker, teachers and school management and nutritionist will be ensured. Perception of the adolescent's mother/immediate caretaker and teachers will be assessed regarding nutrition and WASH practices. Peer lead, "adolescent to adolescent" approach will be used to develop a friendly environment to train the adolescents.

**Institution level:** Modification of the school environment, module development for focus areas and change in the school curriculum will be worked out.

**Community level:** Vendors outside the school will be assessed for food quality and type. Parents and community stakeholders will be involved

**Policy level:** Findings of the study will be shared with the national nutrition program managers and with district education and health officer and advocate the issue at all levels to influence the policy makers. At policy, level there can be nexus of the health ministry and the educational system. However, there will be limitations to influence the policy makers, for example, political instability (high turnover of leadership), lack of political will, dissension among the leadership between the health and the other division of government, resistance from the professional or regulatory bodies, system requirement (human resource), contradictory policies, fair allocation of budget, and lack of social accountability by policymakers.



**Purpose of the study**

To determine a school-based nutrition education and water, sanitation, and hygiene intervention to improve nutritional status among early adolescents.

**Hypothesis**

$H_0$  = There will be no effect of nutrition education and WASH intervention on the prevalence of malnutrition among 6-8 grade school going adolescents.

$H_1$  = There will be a reduction in the prevalence of malnutrition among 6-8 grade school going adolescents through nutrition education and WASH practices.

**Exposure of the study**

1. Nutritional and WASH education module for four months
2. Micronutrient supplementation for three months

**Outcome of the study**

The main outcome is the reduction of malnutrition among school going early adolescents (6 to 8 grade) in a school setting that will be assessed through;

1. Body Mass Index
2. Micronutrients
3. Physical examination
4. Knowledge, attitude, and practices regarding nutrition and WASH

**Measurement of Exposure and Outcome****a. Independent variables /exposure of study**

The module on nutrition education and WASH will be implemented such as;

1. Nutrition education: 12 Sessions will be planned for nutrition education



2. WASH education and practices: 4 sessions will be planned for education and hands-on practices for WASH especially handwashing and personal hygiene
3. Deworming will be administered before and after the intervention

**b. Dependent variables/Outcome of study**

1. Body Mass Index: All school going 6- 8 grade adolescents will undergo anthropometric measurements such as height, and weight (BMI). The measurement will be taken at baseline and end line by using WHO standard growth chart.
2. Micronutrients: Blood sample will be collected twice (baseline and end line) from a subset of 108 adolescents (54 intervention group,54 control group). The blood samples will help to assess the impact of intervention on micronutrient deficiencies (Iron, Zinc, Calcium, CBC, Vitamin D)
3. Physical examination: Physical examination like hair, skin, nail, eye (bitot spot), mouth (dental caries), and goiter will be assessed for micronutrient deficiencies at baseline and end line.
4. Knowledge, attitude, and practices regarding nutrition and WASH: a structured questionnaire will be used to collect data on nutrition and WASH-related indicators. The survey will be administered at baseline and end line. The indicator assessed will be adolescent health status and knowledge, attitude, and practices regarding nutrition and WASH practices.

**Research Question**

1. What is the effect of school-based nutrition education and water, sanitation, and hygiene intervention in improving nutritional status among early adolescents?
2. What is the impact of school-based nutrition education and water, sanitation, and hygiene intervention in reducing the prevalence of malnutrition among early adolescents?

## **Objectives of the study**

### **Primary objective**

To determine the efficacy of school-based nutrition education and water, sanitation, and hygiene intervention to improve nutritional status among early adolescents.

### **Secondary objective**

To measure the impact of school-based nutrition education and water, sanitation, and hygiene intervention on micronutrient levels among early adolescents.

## **Methodology**

### **Study design**

A randomized control trial (RCT) will be chosen to see the results of school-based nutrition education and WASH intervention in early adolescent girls and boys in Gojra, Pakistan. RCT is a type of experimental design in which participants are randomly assigned to either the treatment or the control group, whereas they are not assigned randomly in the other type of experimental design such a quasi-experiment (Handley, 2018). Random assignment in RCT neutralizes factors (other than the independent and dependent variables) that directly infer cause and effect, and also avoids any possibility of selection bias in the trial (Kendall, J. (2003). Moreover, randomization also reduces the risk of unmeasured confounding that bias the study's conclusions (Axelrod, 2006).

This study meets the criteria of RCT which are;

- i. Randomization
- ii. Control group compared to the intervention group
- iii. Manipulation of the variables

In this study, a prospective, comparative experiment will be performed under controlled conditions with random allocation of the participants to both the intervention and control groups.

In the control group, the early adolescents will receive the routine education with free health screening (at the start and end of the study), participation in a health camp at the end of the study, and If the financial resources permit then a safe drinking water facility will be provided at school level as an incentive whereas in the intervention group, intervention (Nutrition education, WASH practices, and deworming) will be applied to the group participants.

### **Study Setting**

For this study, public schools (boys and girls) in Gojra will be selected. There are 40 public schools (20 boys and 20 girls) in Gojra. We will invite the schools for study projects that fulfill the eligibility criteria (inclusion and exclusion criteria). From these willing schools, four public schools that are at least 1-2 Km away from each other (two boys and two girls) will be randomly selected via balloting. The inclusion criterion related to distance is intended to reduce contamination between schools of different arms. These four schools (boys and girls) will then be randomly assigned to either the school (one boy and one girl) with the intervention or to the school (one boy and one girl) without the intervention (Control school).

### **Eligibility criteria for public schools**

#### **Inclusion criteria**

- Schools that have functional facilities of WASH will be selected.
- Single-gender schools will be selected
- Schools that will give informed consent to participate in the study

#### **Exclusion criteria**

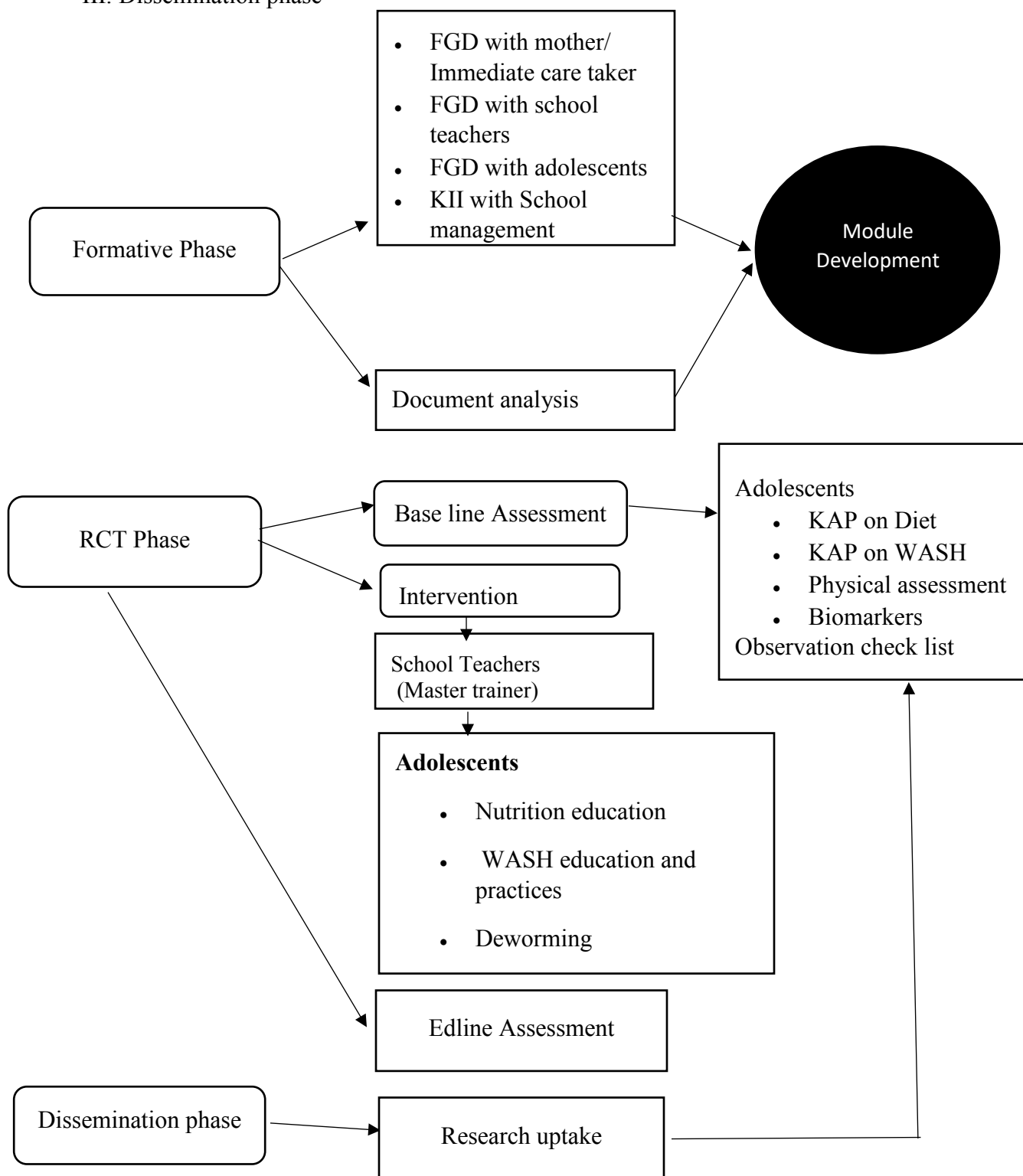
- Schools having a public-private partnership
- School runs by NGO
- School already participating in any other research program

**This study will be conducted in three phases.**

I. Form active phase

II. RCT phase

III. Dissemination phase



**Detail of project activities**

<b>Outline of the study</b>
<b>Formative Phase</b>

<b>Activities</b>	<b>Strategies</b>	<b>Target Population</b>	<b>Channels</b>	<b>Material</b>
Formative assessment qualitative	Focus group discussions (FGDs)	<ul style="list-style-type: none"> <li>• Adolescents (6,7,8 grade)</li> <li>• Teachers</li> <li>• Mothers/immediate caretakers</li> </ul>	Researcher	FGD interview guide
	Key informant interview (KII)	School management	Researcher	Interview guide
	School document analysis	<ul style="list-style-type: none"> <li>• Curriculum of 6,7,8 grade</li> <li>• School policy</li> </ul>	Researcher with teachers	Reviewing school curriculum, textbooks, and policy
<b>RCT Phase</b>				
Baseline assessment	Knowledge, attitude, and practices (KAP) assessment	Early school adolescents (6,7,8 grade)	Researcher	KAP survey questionnaire
	Anthropometric measurement (BMI)	Early school adolescents (6,7,8 grade)	Researcher	-Height scale -weight machine -WHO growth chart
	Micronutrient assessment (complete blood picture, Zinc and serum calcium, Vitamin D)	Adolescents sample (subset of 108 participants, 54 from each group)	LAB (AKU)	A blood test from Lab
	Physical assessment (skin, hair, eyes, nail, tongue, teeth, gums,)	Early school adolescents (6,7,8 grade)	Researcher	Check list
	Observation (Eating and WASH practices) at school	Early school adolescents (6,7,8 grade)	Researcher	Observation checklist
<b>Intervention phase (Duration 4 months)</b>				

Module development	Development of module on Nutrition and WASH component	For early adolescents (6,7,8 grade)	<ul style="list-style-type: none"> <li>• Research team</li> <li>• Nutritionist</li> </ul>	<ul style="list-style-type: none"> <li>• Pakistan Dietary guideline</li> <li>• WHO guidelines</li> <li>• UNICEF guidelines</li> <li>• Literature search</li> </ul>
Workshop	2 workshops will be conducted for the school teachers	For School teachers (Teaching 6,7,8 grade)	Researcher	Based on the Module & teaching strategies
Deworming	Administering Deworming medicine to study participants	Early adolescents (6,7,8 grade)	School teachers	Tab Zentel
	Micronutrient supplementation to study participants	Early adolescents (6,7,8 grade)	School teachers	Micronutrient supplementation 1 tab daily for three months
Healthy diet education	<ul style="list-style-type: none"> <li>• Health education session</li> <li>• Role play</li> <li>• Quiz and games</li> <li>• Flip charts</li> <li>• Log books for food intake</li> <li>• Peer education through a group presentation</li> <li>• Incentive for healthy lunch</li> </ul>	Early school adolescents (6,7,8 grade)	School teachers	<ul style="list-style-type: none"> <li>• Module on Healthy diet</li> <li>• 30-45 min session on nutrition on a weekly basis for 12 weeks</li> <li>• Poster and Charts</li> <li>• Flip charts with key messages</li> </ul>
	<ul style="list-style-type: none"> <li>• Take-home cooking recipes based on local context and food available</li> </ul>	Mother/immediate care taker	<ul style="list-style-type: none"> <li>• Through adolescent (6,7,8, grade)</li> </ul>	<ul style="list-style-type: none"> <li>• Diary/log books</li> </ul>
Water, Sanitation, and Hygiene (WASH)	<ul style="list-style-type: none"> <li>• Showing video on steps of hand washing</li> <li>• Demonstration of hand washing technique</li> <li>• Take home handout</li> </ul>	Early school adolescents (6,7,8 grade)	<ul style="list-style-type: none"> <li>• School teachers</li> </ul>	<ul style="list-style-type: none"> <li>• Module on WASH</li> <li>• 30-45 min session on WASH on weekly basis for 4 weeks</li> <li>• Charts and posters</li> </ul>

The proposed intervention will be finalized after formative assessment (FGDs with teachers and mothers and KI with school management).

**Post-intervention phase (Duration 2 months)**

End line Assessment	KAP survey	Early school adolescents (6,7,8 grade)	Researcher	KAP survey questionnaire
	Anthropometric measurement (BMI)	Early school adolescents (6,7,8 grade)	Researcher	<ul style="list-style-type: none"> <li>• Height scale</li> <li>• Weight machine</li> <li>• WHO growth chart</li> </ul>
	Micronutrient assessment (Blood complete picture, Zinc and Calcium)	30 % of the total Adolescents sample (108 participants, 54 from each group)	LAB (Aga Khan Lab)	Blood test from Lab
	Physical assessment (skin, hair, eyes, nail, tongue, teeth, gums,)	Early school adolescents (6,7,8 grade)	Researcher	Checklist
	Observation (Eating and WASH practices) at School	Early school adolescents (6,7,8 grade)	Researcher	Observation Checklist
<b>Dissemination Phase</b>				
	Research uptake	Stakeholders (adolescents, mother/immediate caretakers, school teachers, school management. community stakeholder	Research team	Health mela, health screening, publication

### **Phase I: Formative phase**

This phase aims to develop a module on Nutrition and WASH components. This phase consists of FGD with adolescents, their mothers/ immediate caretakers, and school teachers. Key informant interviews will also be conducted with school management. Furthermore, the school curriculum and textbooks for 6-8 grade will also be analyzed.

### **Research Questions**



**For school adolescents**

1. What is the perception of 6-8 grade school going early adolescents regarding nutrition?
2. What is the perception of 6-8 grade school going early adolescents regarding Water, Sanitation, and Hygiene?
3. What areas/topics do 6-8 grade adolescents like to learn regarding nutrition and WASH?

**For School Teachers**

1. What is the perception of school teachers regarding adolescents' nutrition?
2. What is the perception of school teachers regarding water, sanitation, and hand-washing practices at school?
3. What is the perception of school teachers regarding the nutritional status of school-going adolescents?
4. What are the teacher's recommendations that how nutrition education and WASH can be built into school programs?

**For Mothers/immediate Caretakers**

1. What is the perception of mothers/immediate caretakers of 6-8 grade school-going adolescents regarding nutrition?
2. What is the perception of mothers/immediate caretakers of 6-8 grade adolescents regarding water, sanitation, and handwashing awareness at five critical times?
3. What are the challenges mothers/immediate caretaker face in fulfilling the nutritional requirement of their adolescents?

**Participants**

Participants will be;

- Early Adolescents (6,7,8 grade students)
- School teachers teaching nutrition-related subjects in 6-8 grade adolescents

- Mother/ immediate caretaker of adolescents
- School management (head teacher/principal)

### **Eligibility criteria for adolescents**

#### **Inclusion Criteria**

- Students studying in 6, 7, and 8 grades
- Informed consent given by adolescent's mothers/immediate caretakers
- Assent was given by the adolescent

### **Eligibility criteria for teachers**

#### **Inclusion criteria**

- School teachers currently teaching nutrition-related subjects to 6,7, and 8-grade students
- School teachers who will give consent to be part of this study

### **Eligibility criteria for mothers/immediate caretakers**

#### **Inclusion criteria**

- Mothers/ immediate caretakers of adolescents studying in 6, 7, and 8 grades
- Mothers/ immediate caretakers who will give informed consent

### **Sample Size & Sampling Strategy**

A purposive sampling technique will be used for the inclusion of the participants. The study participant (adolescents, their mothers/immediate caretakers, and school teachers) will be included in the study from four public schools (2 boys and 2 girls) from Gojra for the FGD. The adolescents, their mothers/immediate caretakers, and teachers will be selected with the help of the school management or Headteacher/school principal. The number of FGDs is 1-2 for each group in this study and will include 8-12 participants. For the key informant interview, the school management from four selected schools will be invited.

### Activities of the Formative Phase

Activities	Target population	Purpose
Focus group discussions	<ul style="list-style-type: none"> <li>• Adolescents</li> <li>• Mothers/immediate care taker</li> <li>• School teachers</li> </ul>	<p>Explore the perception of adolescents regarding nutrition and WASH.</p> <p>Explore their perception of what role school can play to promote healthy diets and WASH practices among adolescents. Their opinion will also be sought to devise strategies for improving dietary and WASH practices.</p>
Key Informant interviews	School management	To explore enablers and barriers to school-based interventions to improve knowledge, attitude and practices related to nutrition and WASH practices among school adolescents.

**School document analysis:** Components of a healthy diet, and personal and environmental hygiene will be assessed in the 6-8 grade school curriculum (6-8 grade textbook). School policy will also be reviewed for the integration of nutrition and hygiene components.

### Validity and reliability

#### Qualitative tool

For FGD, an interview guide will be used. For validation 1-2 interview will be held before identifying the issue that might the respondents face in the interpretation of questions. In the present study, the rigor of the qualitative method will be maintained by using Lincoln and Cuba's (1985) criteria. Trustworthiness of research will be maintained by making the data credible, dependable, transferable, and confirmable (Pandey, (2014). To make the study credible and dependable, following measures will be taken; an interview will be conducted until the

achievement of the saturation. Secondly, detailed information will be provided to the readers about all aspects of the study from design to data analysis, so that readers can understand the study in detail. This will help the reader to monitor whether research practices have been followed in true letter and spirit or not. Prior to the start of the data collection element, the researcher will write and review the reflection, so that the influence of his/ her values will be minimized. Moreover, a thorough discussion will be a continuous part till the finalization of the themes, categories and codes, which will be used for this study.

### **Data collection process**

The principal investigator will collect data. Initially, a meeting with the school principal and teachers will be done to share the overall scope and objectives of the study and to seek for their cooperation throughout the study. Informed consent will be taken from school teachers and mothers/ immediate care takers of 6-8 grade school going adolescents. Secondly, to approach 6, 7, and 8 grade adolescents, informed consent will be first taken from their mothers or immediate caretaker and school management. Also, a written informed assent will be taken from the adolescents available in Urdu and English or local language. Study participants will be briefed about the purpose of the study and assured of anonymity and confidentiality of the information shared. In case, participants have any queries related to the discussion, an explanation will be provided to them.

Focus group discussion (FDGs) with school adolescents, school teachers, and mothers/ immediate caretakers will be conducted with the help of an interview guide. Adolescents (12-16 adolescents

(two-three from each class) will be invited for FDGs with the help of the school management.

12 -16 mothers / immediate caretakers of 6- 8 grade school-going adolescents will be invited for 1-2 FDGs in a school setting. The mothers/ immediate caretakers will be selected with the help

of the school management from intervention and control schools. Also, two to three school teachers from each intervention and control school will be invited for FDGs. All FDGs will be conducted in a separate, quiet, well-lit room in school setting for about 45 minutes to 60 minutes. FDGs will be carried out till the point of saturation. In addition, all four schools (control and intervention) head teachers/principals will be interviewed. Interview will last about 30 minutes and will be conducted with the help of an interview guide.

### **Data analysis plan**

#### **Qualitative data**

Content analysis will be checked through the Creswell framework (Creswell, 2013). This framework consists of five stages. First of all, in the organization of data the text will be transcribed into local language and after that will be translated into English. After that, the code number will be allocated to each transcript. The second step is reading and memorizing in which text will be read several times to develop an in-depth understanding of the data. Data description, classification, and interpretation into themes and codes comprise third step of this framework. For the present study, codes, categories, and themes will be developed as described by Creswell. The fourth step is interpreting the data, where the finding of the study will be compared with the existing literature to verify and identify new findings. Data will be represented and visualized into tabular and figure forms for comprehension.

#### **Phase II. RCT phase**

This phase includes baseline assessment, intervention, and end-line assessment.

##### ***Baseline assessment***

Knowledge, attitude, and practices regarding nutrition and WASH will be assessed among school adolescents through a KAP survey along with anthropometric

measurement, physical assessment, and micronutrient assessment (CBC, Zinc, Calcium,).

The observation on the eating and WASH practices of grade 6-8 adolescents will be done by the researcher during break time (lunch time) and school off timings.

### **Research Question**

1. What is the knowledge, attitude, and practices of 6-8 grade school-going adolescents regarding the importance of consuming a diverse nutrition diet?
2. What is the knowledge, attitude, and practices of 6-8 grade school-going adolescents regarding water, sanitation, and handwashing at five critical times with soap and water?
3. What is the nutritional status of 6- 8 grade school-going adolescents'?
4. What is the level of micronutrient status in 6-8 grade school-going adolescents?

### **Participants**

The study will include both 6-8 grade school-going adolescent girls and boys. The following eligibility criteria will be followed.

### **Inclusion Criteria**

- All students studying in 6, 7, and 8 grades
- Informed consent given by adolescent's mothers/immediate caretakers
- Assent given by the adolescent at baseline

### **Exclusion Criteria**

- Students leave the school during study
- Consent not given by the mother/immediate caretaker will be excluded from the analysis

### **Sample Size & Sampling Strategy**

The sample size was calculated by using PASS software. Sample sizes were estimated to change in nutritional status of early adolescent boys and girls. A sample size of 360 adolescents

(180 in each intervention and control group) will achieve 80% power assuming 42% malnutrition among students in the control arm and at least 6% reduction in the intervention arm having 90 students from each school at a two-sided 5% level of significance.

To assess the micronutrient levels (Iron, Zinc, Calcium, CBC, and Vitamin D) through a blood sample, a subset of 108 adolescents 6-8 grade school going adolescents (54 intervention group, 54 control group) from this total sample size (360) will be selected through random selection.

### **Data collection tool/instrument**

Data will be collected through adopted and adapted self-administered, structured questionnaires from 6,7, and 8-grade school-going adolescents at baseline and the end line. The questionnaire will be categorized into four main groups to assess the respondent's demographic data and their knowledge, attitude, and practices (KAP) about nutrition and WASH. Group A (demographic characteristic), group B contains physical assessment, group C included 24 Questions on KAP on nutrition that are adopted from the KAP manual developed by the Food and Agriculture Organization of the United Nations (2014) and group D are based on the 16 WASH items adopted from GSHS version 2013. The questionnaire will be translated into the Urdu language. Observation of the eating practices, school canteen, WASH, and school environment will be assessed through a checklist at baseline and end line.

### **Activities of baseline assessment**

<b>Activities</b>	<b>Purpose</b>	<b>Frequency</b>
KAP survey	To know the KAP regarding nutrition and WASH	Baseline and end line
Anthropometric measurements	To identify the number of thin, underweight, Overweight, and Obese adolescents in 6-8 grade	Baseline and end line
Physical assessment	To identify the health status of adolescents	Baseline and end line

Monitoring CBC, Zinc, Calcium, and Vitamin D level	To identify the deficiency of micronutrients at baseline and improvement at the end line	Baseline & end line
Observations	To assess the practices related to major determinants of malnutrition i.e. nutrition, water, sanitation, and hygiene.	Baseline & end line

### **Validity and reliability**

#### **Quantitative tool**

Standardization of the questionnaire will be ensured by carrying out a pilot testing on 10 % of 6-8 grade school-going adolescents in a public school from the same urban area (Gojra). Amendments to the tool will be made based on the pilot testing. Adolescents' KAP part will be assessed by questions based on the dietary part of the validated English version of the Food Agriculture Organization (FAO). KAP survey on WASH will be assessed by questions based on the Water, Sanitation, and Hygiene component of the Global School Health Survey (Survey Questionnaire will be translated into the Urdu language).

#### **Data collection process**

The principal investigator will collect data. Initially, a meeting with the school principal and teachers will be done to share the overall scope and objectives of the study and to seek their cooperation throughout the study. Secondly, to approach 6, 7, and 8-grade adolescents, informed consent will be first taken from their mothers/immediate caretakers and school management. Before collecting the data, a written informed assent will also be taken from the participants available in Urdu and English or the local language. Study participants will be briefed about the purpose of the study and assured about anonymity and confidentiality of the information shared. Finally, the survey questionnaire will be completed which will take around 25-30 minutes. In case, participants have any queries related to the questionnaire, an explanation will be provided



to them. Physical assessment will be done by the principal investigator which will take almost 10 minutes/ individual. For the biochemical markers assistance from the local Aga Khan Laboratory will be sought phlebotomists /lab assistants from the Aga Khan laboratory will go to the concerned educational institute and draw blood samples from the participants who have given their consent for the test.

### Data analysis plan

Quantitative variables will be described by means and standard deviations whereas median with interquartile range will be mentioned for qualitative variables. Frequencies and percentages will be calculated for the knowledge, attitude, and practices of adolescents regarding nutrition and WASH. The comparison between intervention and control at baseline and end line will be performed by using paired t-test and Chi-square. For the variables that are not normally distributed, a nonparametric test McNamara will be used. Binary logistic regression and multiple linear regression will be used to assess the effect of intervention. All the statistical analyses will be conducted using SPSS version 23. A p-value less than 0.05 will be considered statistically significant.

Descriptive	Inferential
<ul style="list-style-type: none"> <li>• Mean, SD <i>Normally distributed</i></li> <li>• Median, interquartile range <i>Skewed distribution</i></li> <li>• Percentages and frequencies <i>of knowledge, attitude, and practices</i></li> </ul>	<ul style="list-style-type: none"> <li>• Chi-Square-McNamara <i>knowledge, attitude, and practices</i></li> <li>• T- test paired <i>Continuous variables</i></li> <li>• Binary logistic regression and multiple linear regression</li> <li>• Proportion changes - chi-square <i>Observational checklist</i></li> </ul>

### Intervention Phase

**Study participants**

Early adolescents studying in 6,7, and 8 grades in selected public schools of Gojra and school teachers who are teaching 6-8 grade students.

**Intervention**

The intervention will be planned based on a socio-ecological model and health-promoting school framework. School health environment, health education, health services, and nutrition programs will be focused in the intervention stage of the study.

Based on the formative assessment, the module will be developed in consultation with Nutritionist, the research team, and recent literature. For the validity of the module, expert opinions will be taken from the nutritionist, school education, and WASH experts. Two to three workshops will be arranged for school teachers to train them as master trainers who are teaching 6 to 8-grade school-going adolescents. Sixteen sessions (one session per week) will be arranged on nutrition education and water, sanitation, and hygiene for adolescents. Micronutrient tablets will be administered to adolescents for three months daily through school teachers. Moreover, 6-8 grade adolescents will be dewormed before and after the intervention. In addition, Cooking recipes in the local language will be shared with the adolescent's mother/immediate caretakers through adolescents. Different strategies will be used in the study sessions like demonstrating and showing videos on hand washing, role play, quiz etc.

During the intervention phase, there are no such risks involved to the study participants except their valuable time. Due to deworming and micronutrient supplementation, there may be temporary dizziness, nausea, headache, constipation, and dark color stool along with discomfort from prick for blood drawing from adolescents. To reduce the temporary side effects of deworming administration, the researcher will advise them to keep adequately hydrated themselves and take the micronutrient supplementation tablet. Reassurance regarding drawing

the blood samples will be done. The existing referral system will be identified and utilized if needed

### **Post-intervention phase:**

A KAP questionnaire administered before intervention will be used to assess the changes in knowledge, attitude, and practices of school adolescents in the post-intervention phase. Anthropometric measurement, micronutrient assessment, and physical assessment will also be done to assess the effectiveness of the intervention. Moreover, the checklist will also use to evaluate the changes in the School environment and WASH practices.

### **Phase III: Dissemination phase**

1. After the above-mentioned interventions, a one-day health camp will be arranged for all stakeholders (School children, school teachers, school health staff, and school management). The purpose of this camp is to summarize and reinforce all the concepts of the intervention phase of nutrition and WASH education and, deworming).
  - a. Puppet show
  - b. Games
  - c. Free health assessment for all (height, weight, physical assessment, blood pressure monitoring)
2. Outcome and recommendations of the study will be shared with policymakers and stakeholders for the improvement of the school system. The results of the study will be shared with all the stakeholders (adolescents, teachers, mothers/immediate caretakers). The study will be published in peer review journals, including other media channels. Findings will also share within advocacy groups of nutrition and WASH.

**Ethical consideration**

Study Approval will be obtained from the Aga Khan University Ethical Review Committee (ERC). Approval will also be sort from the participating school management in Gojra. Anonymity, confidentiality, and respect for human dignity are the main concerns in any of research addressing behaviors (Polit & Beck, 2008). Any identification information like name and personnel information will be replaced by codes to address anonymity issues. Confidentiality of the data will be ensured by keeping the data under safe custody, electronic files will also be password protected. Only the primary investigator will access the raw data and the research team members involved in data analysis. Respect for human dignity will be safeguarded by completely informing the participants about all aspects of the study including purpose, their rights including the right to withdraw from the study at any point, and all possible risks and benefits. This information will be communicated verbally as well as in writing in the form of consent /assent. For the adolescent's participation, assent will be obtained after taking permission from their parents / immediate caretaker. The trial will be conducted in compliance with the protocol, GCP, and the applicable regulatory requirement(s).

**Informed consent**

Consent will be taken in the language understood by the participants (Urdu, English, and local language). Informed assent will be taken before the start of the study by providing all the available information about the study. Upon agreement, consent participants will sign the form. For the adolescent's participation, assent will be obtained after taking permission from their parents / immediate caretaker.

**Sustainability of the project**

1. School teachers will be trained as master trainers to teach the nutrition and WASH module to 6-8 grade school-going adolescents.
2. Teachers should be trained in weight and height monitoring.
3. Encourage to change the behavior of adolescents and their parents to improve personal hygiene practices.
4. Findings of the study will be shared with the national nutrition program managers/administrators/policymakers.
5. Findings of the study will be shared with policymakers and suggested to inculcate the module as part of the curriculum.

**Expected outcome**

1. Adolescents' nutritional status will be improved i.e. BMI increase up to the normal range.
2. Knowledge, attitude, and practices regarding nutrition and WASH will be enhanced.
3. Adolescents will adopt WASH practices.
4. Overall, the health of adolescents and personal hygiene practices will be improved.

**Timeline for study:**

After approval of the synopsis and ERC, the selection of schools will be carried out by June 2020, the first phase of data collection will be completed by July 2020, and intervention will be completed by March 2021. Summer and examination breaks will be excluded from the intervention plan. The timeline for the study will also be aligned with the school schedule.

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