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Prokes rematri Web-based App: Development, Testing and Construct Validation of Content to Control Undernutrition at Female Teenager as Early Prevent Stunting in Life Cycle

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Abstract. Several measurements of female teenager undernutrition risk factors have been carried out, but the data are limited and not collected well. Technology approach needed to solve at this problem. This research was conducted to develop Prokes rematri web-based app and analysis CFA and EFA as construct validity. The variables and items as content of beta version were obtained from literature reviews and in-depth interviews who stake holder stunting program as subjects. In this study we limit the science scope about public health, nutrition, and statistic. Data analysis using explanatory factor analysis (EFA) and confirmatory factor analysis (CFA). In conclusion, we had developed Prokes Rematri web-based app and have black box tested. In the other hand, 40 items question as end result of construct validated by EFA and CFA. The scope of questionnaire consist of four topics, that are youth nutrition practice, community support, youth nutrition knowledge, and internal factor of youth nutrition.

Keywords: web-based, application, nutrition, female teenager, stunting

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1. Introduction

Stunting is a chronic nutritional problem in toddlers which signed by low body height of less than 2 SD in height for age index (HAZ)[1]. Intervention stunting in Indonesia has been one of the national program in across sectors since 2018. The goals of this program is 14% prevalence of stunting in toddlers in 2024 [2], [3]. However, in 2023, stunting prevalence still 21,5% [4]. When the program start, stunting was 30,8% in 2018[5]. It is still quite far from the goals in 2024. The stunting management program was carried out with specific interventions and sensitive interventions. Specific intervention is in the health sector area[6]. There are consist of micronutrient supplementation, health care, food supplementation [7]. Meanwhile, sensitive intervention is non-health sector area. There are consist of parenting class, infrastructure improvement to support health accessibility[2].

Stunting intervention is special program than other. This difference lies is in the scope of group targeted and prioritizes prevention, not just management or curative treatment. Stunting toddlers are the main target group which the HAZ calculated[8]. However, the risk factors for stunting are determined by nutritional status of their mother when she was a teenager, during pregnancy and breast feeding and other condition than worsen stunting. Therefore, the target group is not only toddlers buat also female teenager, prospective brides, pregnant and breastfeeding mother.[9] In several studies, 70% of the success program to reduce stunting prevalence came from sensitive intervention [10].

Female teenager is the period of life before the birth of stunting toddler as young generation. However, improving nutrition for female teenager can prevent the birth of lack generation with stunting. Several studies show that female teenagers with nutritional problems, the will have the potential problem to become mother with the nutritional problems too[11]. Pregnant women with nutritional problem are at high risk of giving birth to babies with low birth weight and stunting. Nutritional problems in female teenager have potential to persistent and one of risk of causing the birth of a stunted generation, namely anemia, undernutrition, and chronic energy deficiency (CED)[12]. Data shows that 42% of female teenager suffer from CED, especially at senior high school level. These three nutritional problem can be prevented if right interventions are carried out according to the risk factor[13]. However, the availability of undernutrition risk factor in female teenager very limited. The way to get that data by development instrument. It could be source of information. Several measurements of female teenager undernutrition risk factors have been carried out indirectly by local stakeholders as a stunting prevention program, but the data are limited and not collected well. As a result of the early survey, the local health service carried out nutritional screening on several students during the implementation regular health programs. Previous research has also developed a nutritional literacy questionnaire, but it has not been prioritized for high school adolescent girls[14].

Several questionnaire as result of instrument development to get the similar data using confirmatory factor analysis (CFA) and explanatory factor analysis (EFA). Questionnaire development of nutrition literation in Turkish teenage have wide scope of age, from elementary to senior high school students (10-17 y) [15]. Meanwhile, Food and Nutrition Literacy Questionnaire for Chinese School-age Children (FNLQ-SC) [16] and Food Literacy Instrument (FL) [17]. However, targeted group were early teenager. Food and Nutrition Literacy for Iranian Highschool graduated and youth were developed in 90 items of question, but the scope limit to knowledge and eating skill variables only [18]. CFA and EFA are statistical tool to get construct validity in developing instrument which questionnaire-based. In the globalization era, technology approach need to solve health problem. Transformative phase in healthcare to digital technology, such as web-based app development could be the solution as instrument to monitoring data from those questionnaire [19]. The items in these factors are related to each other. This research was conducted to analysis CFA and EFA to get related item of undernutrition factor in female teenager.

2. Methods

2.1. Study Design

This research was quantitative study and part of development of Prokes Rematri (Profil Kesehatan Remaja Putri = Female Teenager Health Profile) as web-based application. The application link is https://bigdata-prokes-rematri.dinus.ac.id/#/. This study consist of two stages, namely development with the black box testing, and construct validity analysis. Result of this study was validated questionnaire as content of those application. In the beta version of the application, this application also used as data tool to get the validated early. In the early stage, we make 73 items of question. Based on previous result we did, 57 items validated and reliable. The variables and items as content of beta version were obtained from literature reviews and in-depth interviews who stake holder stunting program as subjects. These results were showed in the previous study. The data collected in March until September 2024. In this study we limit the science scope about public health, nutrition, and statistic.

2.2. Sample

The female teenager involved as respondent study. They were consist of 139 girls from 8 senior high school in Semarang city. They belongs to this study by randomly technique. The minimum respondent amount to get factor analysis is more than 100 people [20]. Inclusion criteria were more than 17 years old, mid-arm circumference < 23,5 cm (female teenager undernutrition), and not currently under treatment for chronic disease.

2.3. Data analysis

Data analysis using explanatory factor analysis (EFA) and confirmatory factor analysis (CFA). This factor analysis as construct validity statistics test. This test was used to ensure that the items in questionnaire have related each other and grouping by several indicator, such as latent factor, Kaiser-Meyer-Olkin (KMO), eigen value, cumulative variant, and scatter plot. EFA was carried out in the early stage to determine the grouping of question item based on factor values. Meanwhile, CFA was used to test hypotheses regarding the factor structure in grouping items. SPSS used to EFA analysis and Amos used to CFA analysis.

2.4. Ethics

This research protocol has been approved by the Universitas Negeri Semarang (UNNES) Research Ethics Committee (CEP) with registration number 437/KEPK/EC2023/ Written consent was obtained from all respondents to publish this article. The UNNES Health Ethics Committee declared that the research protocol was feasible, in accordance with the seven standards of the World Health Organization in 2011.

3. Results and Discussion

3.1. Development and Black box testing

This study is part of a study on the development of a website-based application, Prokes Rematri. The results presented in this study include black box testing and statistical validity analysis of the construct. The following is a diagram of the Prokes Rematri app activity:

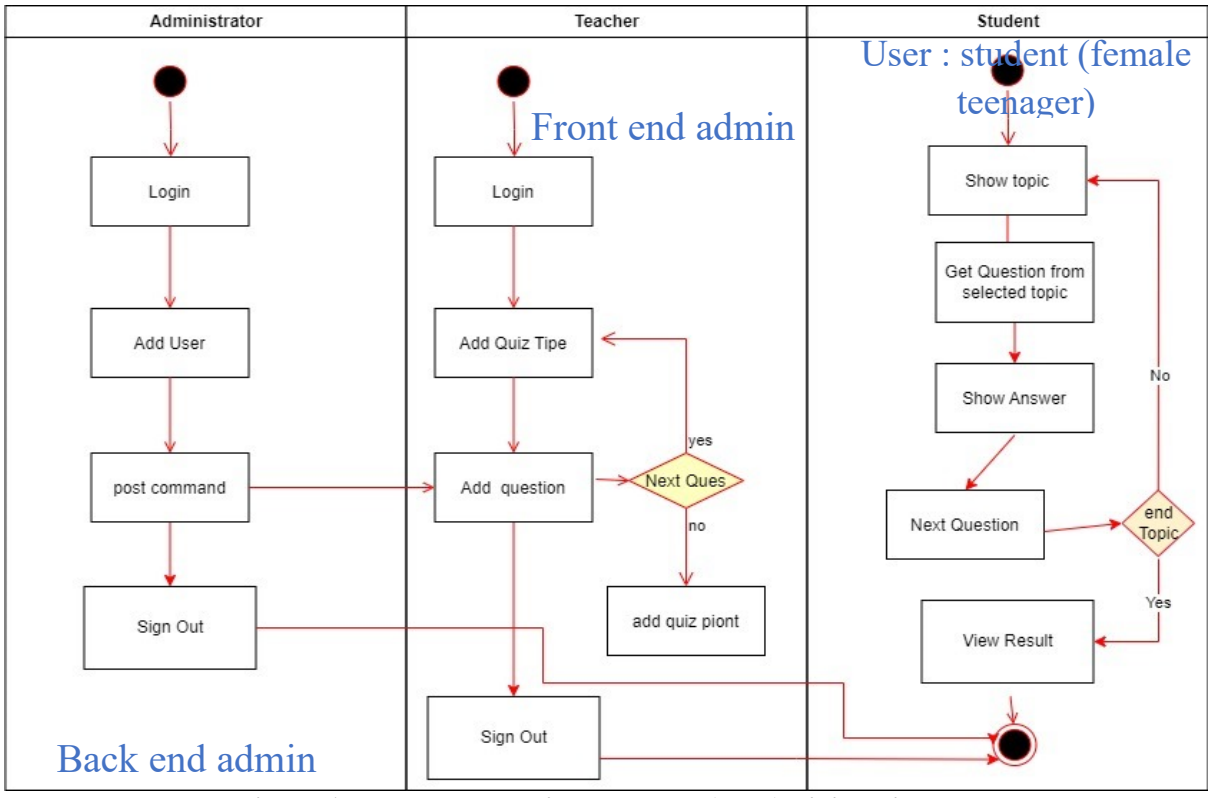
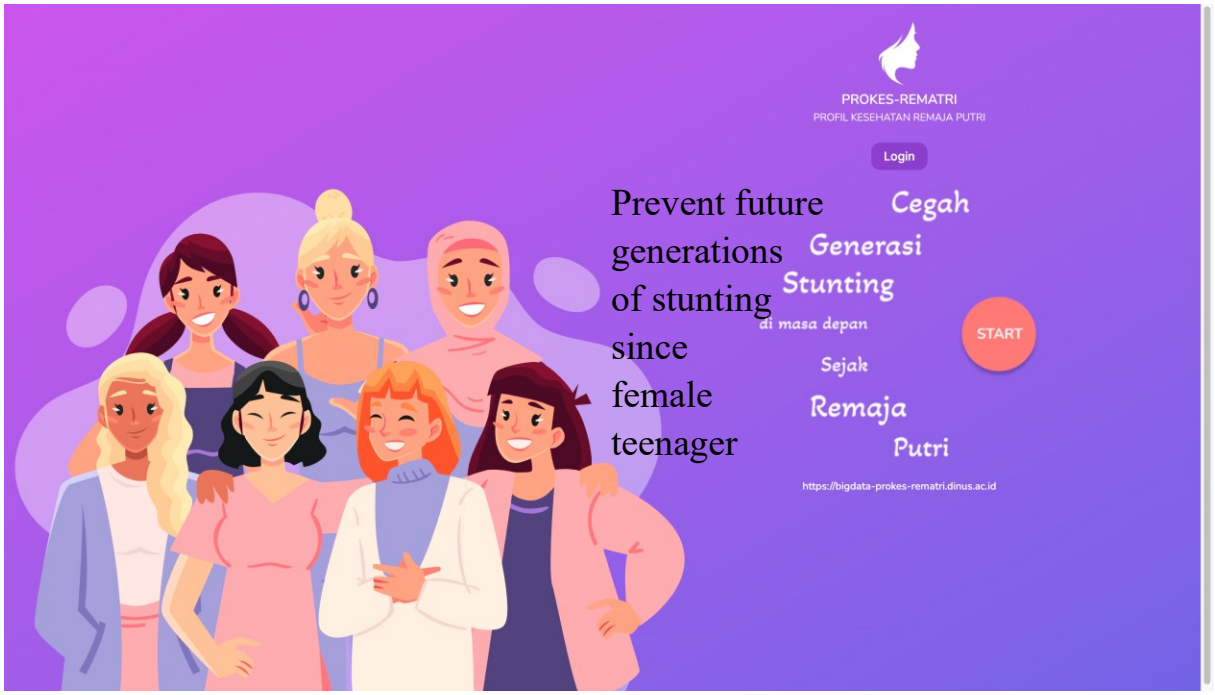


Figure 1. Prokes Rematri Web-based App Activity Diagram

Main user of Prokes Rematri web-based app is student as female teenager. Administrator consist of two person, they are back end and front end. The programmer acts as a back end admin whose job is to add features to the application according to the needs of the front end administrator. The front-end admin acts to ensure that users complete the Prokes Rematri web-based app according to the time agreed upon at each school. Student in the school, especially female teenager acts as user of Prokes Rematri web-based app. Its based on the data need, consist of undernutrition risk factor to early prevent stunting.

This figure bellow showed the interface of Prokes Rematri app. It's a web based app, therefore user did not need to install. All type of smartphone could use it simply.



Web-based link : https://bigdata-prokes-rematri.dinus.ac.id/#/

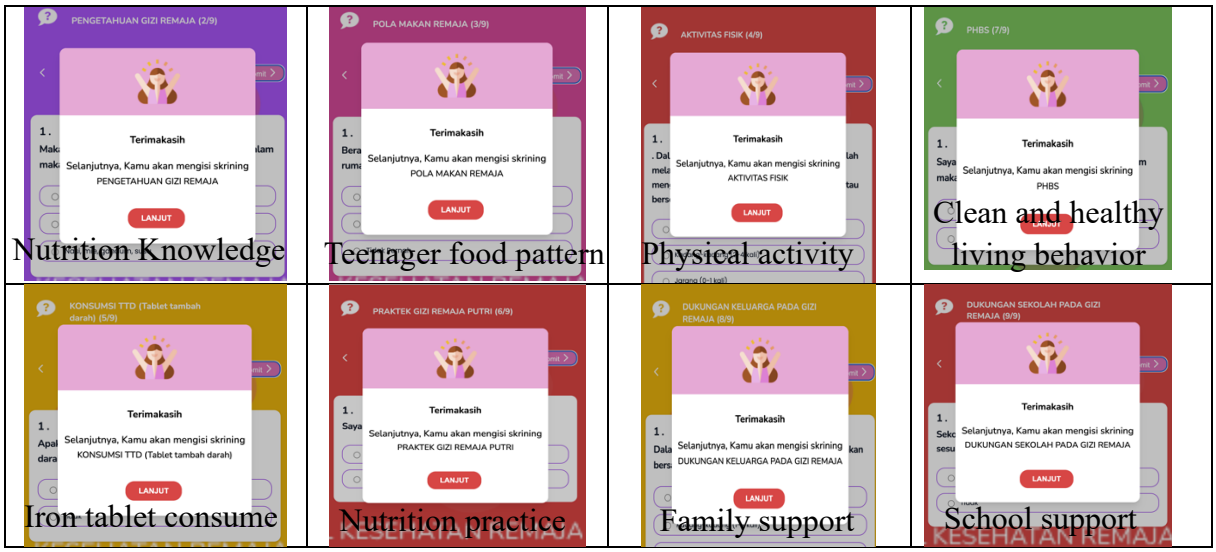


Figure 2. Interface of Prokes Rematri app

Prokes rematri web-based app consist of undernutrition risk factor, namely nutrition knowledge, teenager food pattern, physical activity, clean and healthy living behavior, iron tablet consumption, nutrition practice, family support, and school support. We got this variables as content from the preliminary study that was published in the another article. The application started from the start of the experiment. The user fills in basic identity data and continues by filling in the risk factor variables for malnutrition. Each of these variables is a feature of an application. Each feature has a different colour and there is a message saying thank you for filling it in. This picture below is interface of dashboard Prokes Rematri web-based app.

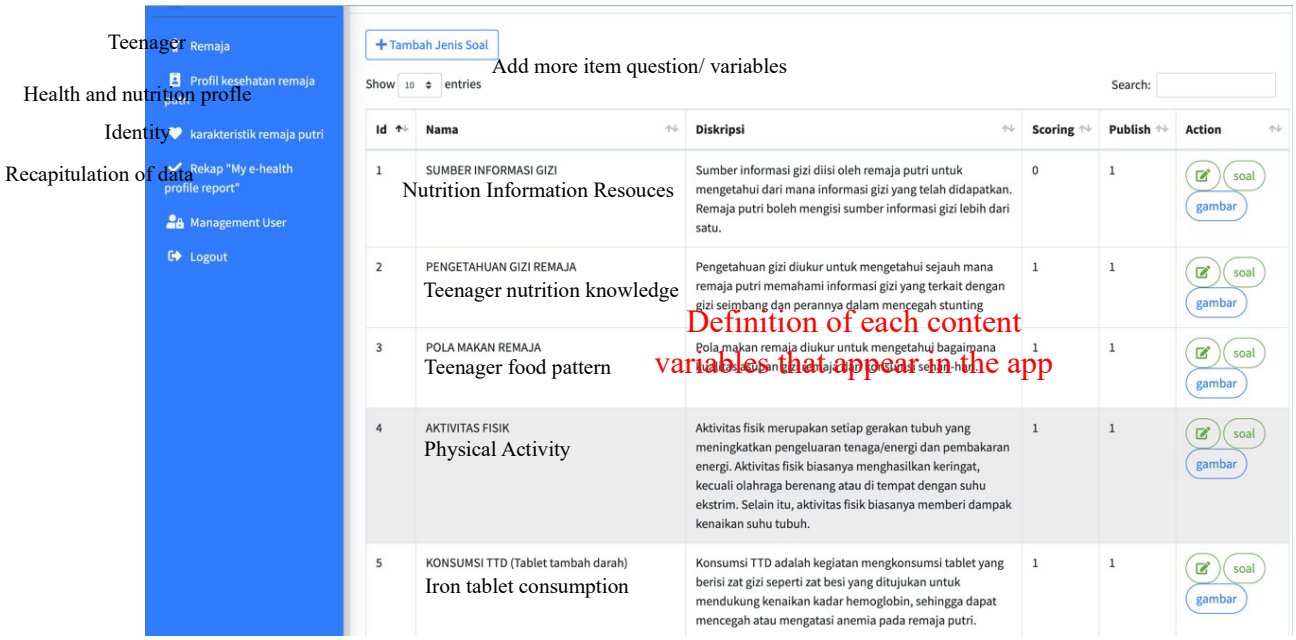


Figure 3. Interface dashboard of Prokes Rematri Web-based app.
https://dashboard.prokesrematri.com/

Administrator as user of those could add or remove the feature based on need. In this dashboard, data from user collected. The front administrator can check which students have not filled in the Prokes Rematri web-based app. They manage that data and report to stake holder, namely head of school, public health center, of educational and culture agency in city.

3.2. Construct Validity

The valid and reliable questionnaire based on the pearson product moment test consist of 57 items question. The scope of them consist of nutrition knowledge, youth food pattern, physical activity, iron supplementation, youth nutrition practice, clean and healthy living behavior, family support and school support. Details scope and amount of items showed in the table 1.

Table 1. Topic, sub topic, and items questionnaire

No	Topic	Sub topic	Item
1.	Nutrition knowledge	Nutrient	3
		Mineral water	2
		Malnutrition	3
		Balance nutrition	2
2.	Youth food pattern	Frequency and kinds of bring packed food	2
		Fast food consumption	2
		Frequency of balance nutrition food consumption	2

No	Topic	Sub topic	Item
		Frequency of drinking ice tea, coffee, and sweetened beverage	1
3.	Physical activity	How many times sport/exercise every week ?	2
		Kind of vehicle to go to school ?	2
		How many times walk to go to school ?	2
		Participation of extracurricular activities school	1
4.	Iron supplementation	How many iron supplementation every month	1
		Weekly Consumption of iron supplementation	2
		Drinking iron supplementation inhibitor	2
5.	Youth nutrition practice	Anthropometric measurement	2
		Calculating nutrition status	2
		Nutritionist counselling	2
		Diet medicine consumption	2
6.	Clean and healthy living behavior	Washing hand at before and after eating	2
		Environment cleaning	2
		Eating utensil cleaning	2
7.	Family support	Sport together	2
		Eating together	2
		Get the nutrition alert	2
		Balance food nutrition food consumption at the house	2
8.	School support	Provide healthy snack at canteen	2
		Anthropometric measurement	2
		School health worker	2

Those validated item was tested by EFA and the result were latent factor value. From 57 item selected, we get 20 latent factor value (table 2).

Table 2. Factor selected by EFA

Item code	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
PGR_1	0,08	0,05	-0,10	0,17	0,54	-0,15	-0,23	-0,04	0,12	-0,04	0,07	-0,16	0,05	0,14	-1,04	0,06	0,07	0,15	-0,09	-0,09
PGR_2	0,00	0,02	0,07	0,32	-0,07	0,39	0,12	0,07	0,08	-0,27	-0,16	-0,06	0,12	-0,27	-0,16	0,20	-0,17	0,07	-0,14	-0,03
PGR_3	-0,19	0,13	-0,30	0,18	0,06	-0,12	0,32	-0,04	0,02	0,11	-0,12	0,00	0,12	0,01	-0,02	-0,11	0,11	0,05	-0,19	0,20
PGR_4	0,01	0,21	-0,09	-0,04	0,07	-0,29	0,39	0,18	-0,06	-0,25	-0,01	-0,03	0,33	-0,15	-0,21	0,06	0,02	-0,05	-0,01	-0,05
PGR_5	-0,08	0,08	-0,07	0,02	-0,12	0,14	0,57	0,19	-0,13	0,23	-0,04	-0,20	0,13	-0,06	0,28	-0,12	-0,10	0,02	0,05	0,10
PGR_6	0,15	0,02	0,15	-0,02	0,22	0,10	-0,01	-0,12	-0,01	0,35	0,11	0,12	0,22	0,14	0,08	0,14	-0,14	-0,07	-0,23	1,06
PGR_7	0,07	0,09	-0,01	-0,20	-0,02	0,39	0,18	0,07	-0,27	-0,03	0,18	0,19	-0,16	-0,09	0,34	-0,18	0,30	0,12	0,02	0,23
PGR_10	0,09	-0,01	-0,09	-0,04	-0,06	0,01	0,12	-0,09	0,03	-0,12	0,03	0,06	-0,06	-0,16	-0,12	0,98	-0,11	-0,34	0,15	0,17
PGR_13	-0,07	0,05	0,01	0,19	0,13	0,14	0,11	0,09	0,00	-0,45	0,13	-0,24	-0,35	-0,02	0,18	0,36	-0,28	-0,06	0,22	0,24
PGR_15	0,02	-0,02	0,29	-0,13	-0,07	0,24	1,05	0,03	0,18	-0,19	0,04	0,11	0,07	0,19	0,15	0,17	0,06	-0,10	0,01	-0,03
PMR_1	-0,01	0,36	-0,20	-0,06	-0,21	-0,30	0,04	0,10	-0,04	0,09	-0,20	-0,11	-0,05	0,10	-0,05	0,18	0,07	-0,40	0,09	0,00
PMR_3	0,03	-0,10	-0,04	0,33	-0,08	0,01	-0,06	-0,02	-0,19	0,01	0,31	-0,13	-0,39	0,25	0,06	-0,11	-0,29	-0,22	-0,16	0,03
PMR_4	0,00	0,14	-0,02	0,05	-0,01	-0,10	-0,06	0,05	0,14	-0,07	-0,03	-0,19	-0,26	-0,01	-0,17	-0,30	0,05	0,94	0,08	-0,08
PMR_5	-0,02	-0,05	0,06	-0,14	0,14	-0,10	0,11	0,66	-0,02	-0,11	-0,08	-0,09	-0,03	0,37	0,13	-0,25	0,07	0,03	-0,27	0,03
PMR_6	-0,08	0,32	0,03	0,04	-0,07	0,27	-0,52	0,10	0,00	0,27	0,06	0,06	0,07	-0,06	-0,23	-0,01	0,18	-0,19	-0,28	0,28
PMR_7	0,10	-0,05	-0,05	-0,05	0,07	0,02	0,12	-0,06	0,05	-0,04	0,02	-0,01	-0,07	0,92	-0,13	-0,15	-0,20	0,05	-0,16	0,20
PMR_9	-0,13	-0,18	0,21	-0,06	-0,24	0,09	-0,01	0,08	0,09	-0,01	-0,53	-0,14	0,09	0,25	-0,10	0,02	0,00	0,08	-0,06	0,27
AF_1	0,13	0,08	-0,01	-0,14	0,21	0,45	0,03	0,21	0,24	0,20	-0,07	-0,21	0,15	0,06	-0,01	-0,06	0,00	-0,15	0,15	-0,19
AF_2	-0,06	-0,05	-0,19	0,12	0,04	0,91	0,18	0,06	0,04	0,26	0,02	-0,06	-0,16	0,07	0,14	0,03	0,02	-0,08	0,10	0,12
AF_3	0,08	0,19	0,01	-0,04	0,10	0,34	-0,01	-0,02	0,35	0,17	0,13	-0,43	-0,05	-0,06	-0,06	-0,14	-0,11	-0,17	-0,21	-0,05
AF_4	0,23	-0,02	-0,03	-0,02	0,12	0,09	0,24	-0,17	0,74	0,10	0,00	0,00	-0,03	0,02	-0,07	-0,10	0,04	0,07	0,24	-0,19
AF_5	-0,07	0,01	-0,11	0,13	-0,09	0,27	-0,09	-0,03	0,02	1,05	0,15	0,06	0,22	-0,07	0,04	0,00	0,12	-0,07	0,15	0,33
AF_6	0,01	0,12	-0,19	0,15	0,00	0,11	0,05	-0,23	0,22	0,15	0,01	0,02	-0,10	-0,13	0,06	0,10	0,25	0,07	0,96	-0,23
AF_7	-0,03	-0,06	0,10	-0,06	0,01	-0,07	0,03	-0,07	0,17	0,17	0,04	0,87	0,02	0,01	0,21	0,06	0,00	-0,15	0,03	0,16
KTTD_1	0,26	-0,08	0,01	0,18	0,04	0,10	-0,07	0,02	0,33	0,20	-0,24	0,25	-0,05	-0,03	0,37	-0,11	0,03	-0,13	0,31	0,14
KTTD_2	-0,06	-0,11	-0,04	0,05	-0,19	0,29	0,19	0,81	-0,10	0,25	-0,05	0,09	-0,04	-0,08	-0,21	-0,06	-0,01	0,06	-0,02	-0,21
KTTD_3	-0,02	-0,19	0,06	0,03	0,05	0,02	0,00	0,03	-0,07	0,20	-0,04	-0,01	0,15	-0,17	-0,06	-0,13	0,98	0,04	0,26	-0,15
KTTD_4	0,14	0,06	0,13	-0,02	0,18	-0,14	0,13	0,05	-0,21	0,29	0,10	0,05	1,04	-0,02	-0,08	-0,04	0,10	-0,24	-0,10	0,22
KTTD_5	0,23	-0,12	-0,07	0,28	-0,05	-0,06	-0,32	0,24	-0,08	-0,05	0,01	-0,08	0,20	0,06	0,13	-0,05	-0,03	0,03	0,26	-0,02
PGRP_1	0,49	0,08	-0,15	0,20	-0,04	0,22	-0,06	-0,03	-0,38	-0,08	-0,24	-0,17	-0,12	0,11	0,07	0,06	0,25	0,11	0,00	0,01
PGRP_2	0,76	0,14	0,09	0,01	0,13	0,13	-0,03	-0,04	0,06	-0,12	0,01	-0,22	-0,04	0,06	-0,03	0,16	0,31	0,01	-0,06	0,03
PGRP_3	0,91	0,01	0,11	0,02	-0,22	-0,16	-0,01	-0,12	0,17	0,05	0,00	0,04	0,16	-0,02	-0,08	0,03	0,12	-0,11	0,08	0,25
PGRP_4	0,79	-0,05	-0,12	0,09	-0,14	0,14	0,20	-0,08	0,10	-0,03	-0,06	0,07	0,11	0,15	-0,04	-0,06	-0,28	0,05	-0,25	0,05
PGRP_5	0,69	-0,17	-0,10	-0,07	-0,17	-0,05	-0,09	0,12	0,01	-0,01	0,17	0,10	0,23	0,01	0,01	-0,08	-0,08	-0,09	0,24	-0,07
PGRP_6	0,78	0,03	0,23	-0,08	0,01	-0,15	-0,08	0,11	0,03	-0,03	0,00	0,00	-0,05	0,03	-0,04	0,12	-0,16	0,11	0,04	0,01
PGRP_7	-0,25	-0,13	-0,03	0,16	0,95	0,04	0,04	-0,03	0,18	-0,05	-0,07	0,07	0,17	-0,05	0,12	-0,03	0,07	-0,05	0,01	0,19
PGRP_8	-0,18	-0,12	-0,07	0,13	0,97	0,08	-0,15	0,09	0,08	-0,14	-0,05	-0,02	0,12	0,18	-0,19	-0,05	0,01	0,05	-0,01	0,17
PHBS_1	-0,04	-0,03	0,07	0,08	-0,09	0,03	-0,01	0,00	0,10	0,20	0,87	0,02	0,15	0,03	-0,08	0,06	-0,06	-0,03	0,00	0,16
PHBS_2	-0,04	0,29	0,05	-0,22	0,12	-0,01	-0,08	-0,01	0,83	-0,08	-0,14	0,20	-0,27	-0,05	-0,05	0,17	-0,11	0,11	0,08	0,14
PHBS_3	-0,08	-0,07	-0,13	-0,09	-0,23	0,13	0,07	0,14	0,43	-0,03	0,54	0,08	-0,15	0,21	-0,25	-0,05	0,13	0,26	0,11	0,15
PHBS_4	0,41	-0,32	-0,01	0,05	0,19	-0,09	0,13	0,17	0,24	-0,15	-0,03	-0,02	-0,32	0,01	-0,22	0,17	0,40	-0,10	-0,07	-0,04
PHBS_5	0,06	-0,13	0,00	-0,15	0,14	-0,01	-0,09	0,78	-0,08	-0,23	0,11	-0,08	0,13	-0,37	0,16	0,06	0,04	0,01	-0,21	-0,06
PHBS_8	0,08	-0,01	0,03	0,07	-0,07	-0,35	-0,09	0,16	0,25	0,20	0,03	-0,12	-0,16	-0,62	0,11	-0,06	-0,06	0,31	-0,13	0,17
DKPGR_1	-0,08	0,14	0,07	0,12	-0,11	-0,12	0,10	-0,11	0,03	-0,25	0,21	-0,14	0,32	0,14	0,25	-0,04	0,16	-0,01	-0,04	-0,29
DKPGR_2	-0,20	0,19	-0,03	0,15	-0,02	-0,06	-0,03	0,20	0,18	0,14	0,06	0,23	0,03	0,14	0,20	0,33	0,09	0,01	-0,05	-0,17
DKPGR_3	-0,01	0,56	0,15	-0,02	0,06	0,03	0,11	0,06	0,04	0,24	0,12	-0,37	0,25	0,04	-0,02	0,07	0,00	0,20	0,27	0,12
DKPGR_4	0,07	0,97	-0,02	-0,06	0,02	-0,12	0,01	-0,21	0,12	-0,09	0,06	-0,10	0,17	0,00	-0,08	-0,09	-0,07	0,16	0,17	0,15
DKPGR_5	0,33	0,37	-0,07	0,06	0,11	-0,08	0,02	0,11	-0,10	0,16	-0,01	0,23	-0,04	0,21	-0,07	0,11	-0,14	0,36	0,02	0,11
DKPGR_6	0,14	0,29	-0,10	0,21	0,14	0,01	-0,01	0,16	0,04	-0,20	0,13	0,55	0,21	0,00	-0,08	-0,06	-0,12	-0,14	-0,03	-0,09
DKPGR_8	-0,08	0,87	0,01	-0,02	-0,26	0,07	0,01	-0,04	0,12	-0,01	-0,08	0,10	-0,10	-0,11	0,04	-0,02	-0,22	-0,01	-0,08	-0,19
DKPGR_9	0,25	0,32	0,05	-0,05	-0,01	0,02	-0,21	0,06	0,17	-0,18	-0,10	0,07	-0,18	-0,04	0,34	-0,24	-0,06	-0,05	-0,08	-0,12
DSPGR_3	0,08	0,03	0,85	0,11	-0,08	-0,24	0,05	0,00	-0,05	-0,12	0,04	0,03	0,13	-0,10	0,14	-0,12	0,03	0,04	-0,18	0,20
DSPGR_4	0,10	0,04	0,93	0,19	-0,01	-0,06	0,21	0,00	0,05	-0,13	-0,04	0,04	0,14	0,02	0,05	-0,09	0,04	-0,06	-0,14	0,09
DSPGR_5	-0,16	0,29	0,25	0,12	0,00	-0,06	0,00	0,05	-0,03	-0,33	-0,05	0,07	-0,11	0,03	-0,15	-0,51	0,10	-0,12	0,21	-0,06
DSPGR_6	-0,05	0,02	0,51	0,55	-0,06	-0,07	0,17	0,04	0,01	0,20	0,08	0,10	-0,26	-0,04	-0,07	-0,02	0,10	0,06	0,05	-0,13
DSPGR_7	0,07	-0,01	0,08	0,87	0,22	0,22	-0,07	-0,13	-0,07	-0,10	-0,08	0,01	-0,07	0,00	-0,07	-0,12	0,01	0,16	0,14	0,06
DSPGR_8	-0,02	-0,06	0,21	0,90	0,07	-0,02	-0,09	-0,05	-0,18	0,23	0,15	-0,04	0,05	-0,11	-0,17	0,04	0,04	-0,06	0,10	-0,07
	6,13	4,31	3,07	2,55	2,10	2,00	1,87	1,79	1,75	1,65	1,58	1,47	1,43	1,38	1,28	1,16	1,12	1,10	1,04	1,01
	10,75	7,56	5,39	4,47	3,68	3,50	3,29	3,14	3,07	2,90	2,77	2,58	2,50	2,43	2,25	2,04	1,96	1,93	1,82	1,77
	10,75	18,31	23,70	28,17	31,85	35,35	38,64	41,78	44,85	47,75	50,52	53,10	55,60	58,03	60,29	62,32	64,28	66,21	68,03	69,79

Factor 10,14,17, and 19 were deleted because they resulted only one item. Those EFA resulted eigen value 1,01 and 69,79 % cumulative factor from 20 factor. Meanwhile, every eigen value and variant for each factor showed by table 2.

Table 3. KMO, Eigen value, and variant

Factors	KMO	Eigen Value	Explaned variance (%)	Cummulative Explaned Variance (%)
Factor 1	0,588	6,13	10,75	10,75
Factor 2		4,31	7,56	18,31
Factor 3		3,07	5,39	23,70
Factor 4		2,55	4,47	28,17
Factor 5		2,10	3,68	31,85
Factor 6		2,00	3,50	35,35
Factor 7		1,87	3,29	38,64
Factor 8		1,79	3,14	41,78
Factor 9		1,75	3,07	44,85
Factor 10		1,65	2,90	47,75
Factor 11		1,58	2,77	50,52
Factor 12		1,47	2,58	53,10
Factor 13		1,43	2,50	55,60
Factor 14		1,38	2,43	58,03
Factor 15		1,28	2,25	60,29
Factor 16		1,16	2,04	62,32
Factor 17		1,12	1,96	64,28
Factor 18		1,10	1,93	66,21
Factor 19		1,04	1,82	68,03
Factor 20		1,01	1,77	69,79

Those table showed 0.588 for KMO value. It was more than 0,5 ([20], [21]. The analysis could continue to CFA test. The KMO value was used to measure the adequacy of the sample size and compare the magnitude of the observed correlation coefficient with the magnitude of the partial correlation coefficient. A small KMO value indicates that the correlation between items could not be explained by other items and the factor analysis have to stop. The eigen values for the 20 factors range from 1.01 to 6.12. This value meets the cut off assumption of eigen value > 1 to be able to continue CFA test. The cumulative variance value was 69.79%. Though, there is no limitation value for those variance, this study result cumulative variance more than 50%. This value was greater than similar study with the topic about dietary behavior in Brazil which only reached 57.1% for cumulative variance and the highest eigen value of 3 [22]. Apart KMO, eigen values, and cumulative variance, EFA analysis was supported by the scatter plot below.

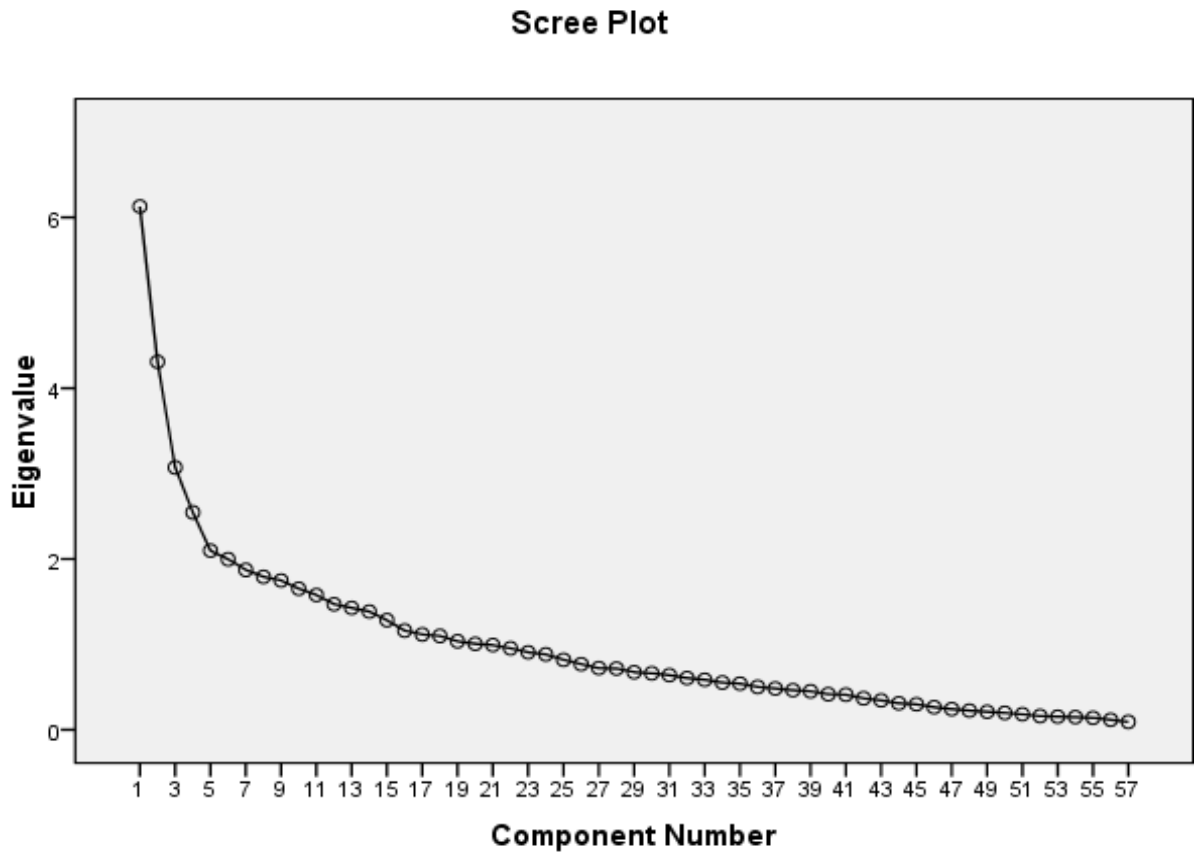


Figure 4. Scree Plot of 57 item questions

Based on the scatter plot, most of items from 57 items, clustered close together and tend to be on the curve below. There were only about 4 items positioned at the top and quite far from other question items. This means that there was a close correlation between the question items. Furthermore, it could be continue with CFA test. The first CFA was carried out by removing factors that had a value of less than 0.5. There were 6 factors deleted. However, the last result of this factor analysis was a model. It determined by goodness of fit index model. In the table 3, showed that values of model from first order to second order and from 14 factors to 11 factors. This study choose the best model. Each model from goodness fit index in supplementary file 1.

Table 4. Analysis Goodness of Fit Index

Goodness of Fit index	Cut off value	14 Factors- CFA 1st Order		12 Factors- CFA 1st Order		11 Factors- CFA 1st Order		11 Factors- CFA 2nd Order	
		Model test value	Model evaluation	Model test value	Model evaluation	Model test value	Model evaluation	Model test value	Model evaluation
RMR	≤ 0,08	0,027	Good Fit	0,024	Good Fit	0,025	Good Fit	0,028	Good Fit
RMSEA	≤ 0,08	0,05	Good Fit	0,058	Good Fit	0,043	Good Fit	0,06	Good Fit
GFI	≥ 0,90	0,723	Closed fit	0,745	Closed fit	0,753	Closed fit	0,730	Closed fit

Goodness of Fit index	Cut off value	14 Factors- CFA 1st Order		12 Factors- CFA 1st Order		11 Factors- CFA 1st Order		11 Factors- CFA 2nd Order	
		Model test value	Model evaluation	Model test value	Model evaluation	Model test value	Model evaluation	Model test value	Model evaluation
AGFI	≥ 0,90	0,673	Closed fit	0,696	Closed fit	0,705	Closed fit	0,695	Closed fit
CMIN/ DF	≤ 2,00	1,444	Good Fit	1.465	Good Fit	1,459	Good Fit	1,503	Good Fit
CFI	≥ 0,80	0,648	Closed fit	0,724	Closed fit	0,741	Closed fit	0,700	Closed fit

CFA was carried out on first orders up to second orders with a total of 4 stages. Initially consisting of 20 factors (table 1), then several factors were eliminated because they had a value <0.5. Furthermore, that up to the CFA second order the resulting RMR value is 0.028; RMSEA 0.06; GFI 0.73; AGFI 0.695; CMIN 1.5 and CFI 0.7. Of these 6 values, RMR, RMSEA, and CMIN have models that meet the cut off value. Meanwhile, GFI, AGFI and CFI do not meet the cut of value, but are close. From several CFA analyzes that were tried, the second order model with 11 factors was the best. The final result is question items with the factor and item models below.

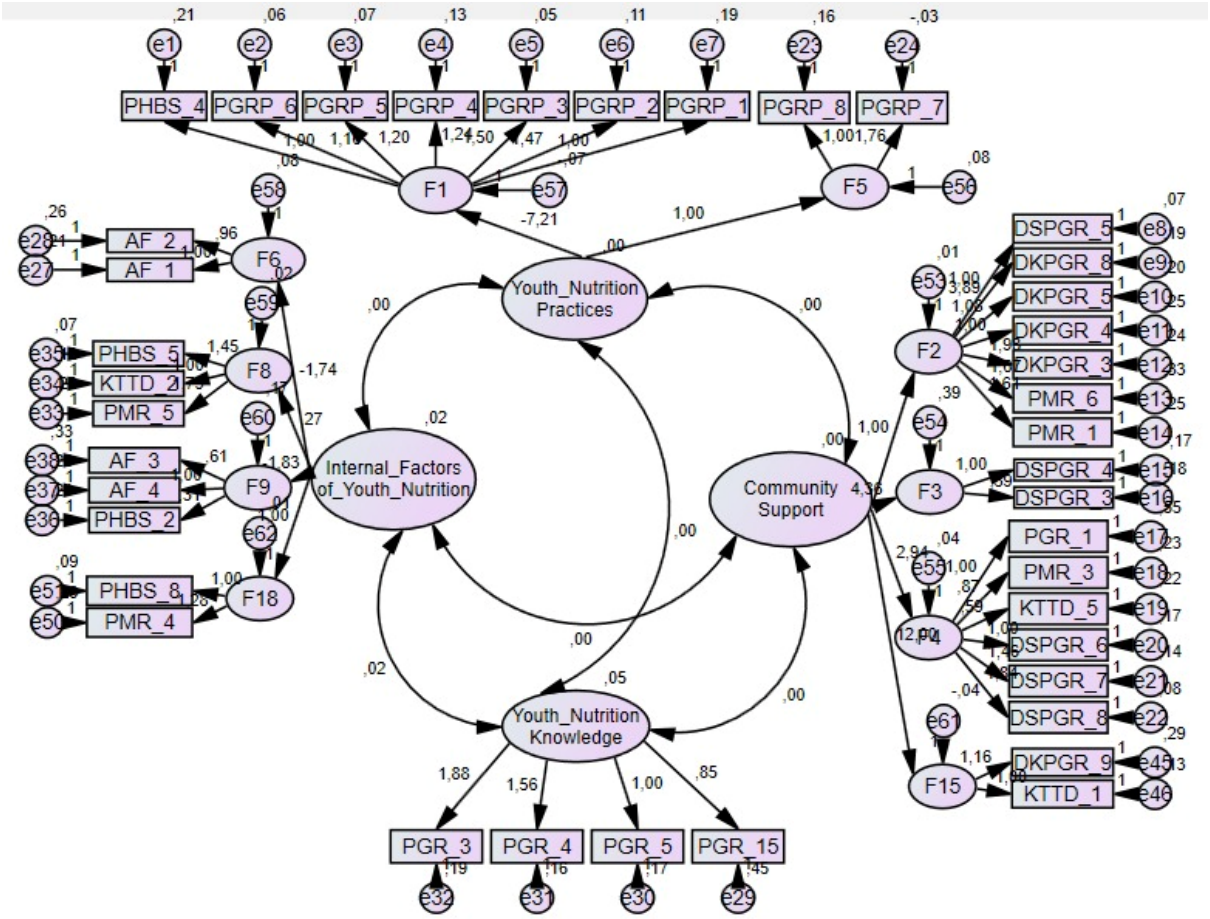


Figure 5. The standardized estimate of CFA model for calibration and validation sample

40 items from 57 items selected and spread across 11 factors and grouped into four variables. There were four groups of variables that are risk factors for undernutrition in adolescents, namely adolescent

nutritional practices, environmental support, internal factors for adolescent girls, and nutritional knowledge. To make it easier to construct the model, question items are arranged in codes. The table presents question items based on groups, factors and codes selected for the goodness of fit index model.

Table 5. Item's code description

No	Variables	Factor	Code	Item
1.	Youth nutrition practice	F1	PHBS 4	I do routine exercise, even its not subject schedule at school
2.			PGRP 1	I always weigh my body weight every month
3.			PGRP 2	I measure my height every month
4.			PGRP 3	I measure mid-arm circumference every month
5.			PGRP 4	I calculate my nutritional status using application
6.			PGRP 5	I use app to measure my nutrient intake
7.			PGRP 6	I consul nutritionist at website
8.		F5	PGRP 7	I consume diet medicine by self pay at online market place
9.			PGRP 8	I make limitation special food by my self to do special diet
10.	Community support = School and family support	F2	DKPGR 3	My mother/servant always cook by her self everyday
11.			DKPGR 4	My mother/servant always use fresh food ingredient as material to cook
12.			DKPGR 5	My family have simple anthropometric tools in our home, such as digital scale and microtoa
13.			DKPGR 8	I always bring balance nutrition packed lunch from my mother
14.			PMR 1	How many times bring packed lunch from home ?
15.			PMR 6	Do you always consume vegetable on your every meal menu ?
16.		F3	DSPGR 5	My school always held nutrition/ health education
17.			DSPGR 3	My school measure body weight of students every year
18.			DSPGR 4	My school measure height of students every year
19.			PGR 1	Every girls need balance nutrition to grow and active
20.			PMR 3	How many times eat junk food with your peer group every week ?
21.			KTTD 5	Do you always find health information about iron supplementation to make sure that is important ?
22.		F4	DSPGR 6	Mother/father/another member of my family give nutrition education for my family member that have nutritional problem
23.			DSPGR 7	My school program consist of simple care for sick students, nutrition monitoring, and health education
24.			DSPGR 8	My school have health worker to manage school health program
25.			DKPGR 9	My family always exercise together every week
26.		F15	KTTD 1	Did you consume iron supplementation every week for last three months
27.	Youth Nutrition Knowledge		PGR 3	Choose the low nutritional food (vegetable, fruit, and bread)
28.			PGR 4	Consume 2 L mineral water every day make our body health

No	Variables	Factor	Code	Item
29.			PGR 5	Choose the impact of low nutrition food (Increasing physical activity, girls will healthy, or decreasing immunity)
30.			PGR 15	Choose the rich of protein (tofu and tempeh, tofu and egg, meat and egg)
31.	Internal	F6	AF 1	In the 7 last days, how many days you do heavy activity
32.	factor of		AF 2	How many hour you do that activity ?
33.	youth nutrition	F8	PHBS 5	I always support clean activity at school, like eradication of larvae
34.			KTTD 2	Did your school always give nutrition information why girls need consume iron supplementation ?
35.			PMR 5	I always consume balance food nutrition as protein, carbohydrate, fat, fiber in my packed lunch
36.		F9	AF 3	In the 7 last days, how many days you do middle activity ?
37.			AF 4	How many hour average to do that activity ?
38.			PHBS 2	I always consume healthy snack
39.		F18	PHBS 8	I join environmental cleaning activities together in my neighbourhood
40.			PMR 4	How many times consume healthy food snack at school every week ?

The four risk factor variables for female teenagers above are actually groupings based on items selected from factor values and eigen values. However, the causes of under nutrition in female teenagers were determined by many risk factors. Direct factors include nutritional intake and the presence or absence of infectious diseases. Indirect factors include parenting patterns in the family, availability of food, and health services. In the chart on the causes of undernutrition, it was also stated that the root causes of under nutrition in female teenager include the economic and political crisis of a country [23], [24]. Improving nutrition in female teenager was related to the birth of stunting or normal generation in the future. The creation of quality female teenager as a product providing balanced nutrition will create prospective brides and grooms who were free from nutritional problem. Furthermore, to be a pregnant woman and breastfeeding mothers who were well-nourished [25]. The future goals, when they become mothers in their respective families, the implementation of balanced nutrition would be maintained well. Stunting prevention was not only carried out through improving the quality nutrition of female teenager, but also for pregnant and breastfeeding mothers, babies, and toddlers [26]. Pregnant and breastfeeding mothers receive intervention in the form nutritional supplementation, food feeding supplementation, cadres (volunteer health worker). Babies and toddlers receive various intervention too [2]. Female teenager received iron supplementation provided through the school. This was not specially intervention designed to prevent stunting because iron supplementation was long term program since 2014 [27].

The development of this questionnaire was designed as an innovation for data management on risk factors for undernutrition in female teenager. As an initial stage for stunting prevention innovation, the teenager population whose nutritional risk factors were measured were third grade high school students. This period was a transition period towards adulthood. Even, several female teenager who graduate from senior high school did not continue to college but get married straight away. Goals of this questionnaire, we hoped that female teenager and the parties involved would become more aware of adolescent nutrition. The questionnaire developed included expert validity, criterion validity, and construct validity. The use of factor analysis as a test of construct validity was a further stage compared to several other adolescent nutrition questionnaires that have been developed in Indonesia. EFA and CFA can determined items question by taking into calculate eigen values and KMO value contributions as well as cumulative

variance. Beside from that, is was also able to group these items into a factor. The purpose of factor analysis was determined that a set of variables could be described based on a smaller number of dimensions or factors than the number of variables. Factor analysis was a study of interdependence between variables with the aim of finding new item grouping with fewer items than the original items. In general, when preparing questionnaires, expert validity and pearson product moment test were often used. In this research, the final stage of validity was completed with factor analysis as a construct validity test. We found youth nutrition practice, community support, youth nutrition knowledge, and internal factor of youth nutrition. Youth nutrition practice consist of 9 items, that are daily exercise, maintaining anthropometric parameter, managing dietary intake. Community support consist of school and family support, consist of 16 items. The question about role of their mother in preparing food at home and packed lunch, iron supplementation consumption, workout together, health worker at school, eating junk food, measure weight and height body at school. Youth nutrition consist of 4 items, that are knowledge about balance nutrition that correlate with preventing stunting by maintaining nutritional status since female teenager. Internal factor of youth consist of 10 items, that are about nutrition knowledge, consume balance nutrition, junk food, activity and sport.

There were some limitation we acknowledged. This questionnaire only have scope at four variable. Besides that, validated only at students in the big city with best internet connection, social economic, and culture that different with students at small city or rural. Therefore, there is still some room left for conducting study on implementing under nutrition risk factor at female teenager

4. Conclusion

In conclusion, we had developed and validated item questionnaire about undernutrition risk factor in female teenager over 17 years old. We got 40 items question as end result of validated by EFA and CFA. The scope of questionnaire consist of four topics, that are youth nutrition practice, community support, youth nutrition knowledge, and internal factor of youth nutrition. The developed questionnaire to be content of Me-PHR web-based application. The data output from this questionnaire provide an effective tool for assessing and monitoring than undernutrition factor of female teenager among senior high school students.

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