

Muscle Dysmorphia in Fitness Center Members: Its Affecting Factors and Impacts

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Abstract

Muscle dysmorphia (MD) has several impacts on the decline in social and health functions. This study aimed to determine the correlation between MD with eating behaviors and exercise loading among fitness center members and analyze the factors affecting it. This study used a cross-sectional design with 100 subjects chosen by a consecutive sampling method at three fitness centers in Semarang City. The subjects were all male members of an active fitness center between 17 and 45 years. The data of MD were obtained using the Drive Muscular Scale (DMS), while eating behavior data were obtained using the Eating Attitude Test-40 (EAT-40) and the training load data, including the duration and frequency of weight training data. Social influence data, self-esteem data, and perfectionism data were obtained using a questionnaire. The findings revealed that 61% of the subjects experienced MD, 80% experienced impaired eating behavior, and 80% consumed supplements. There was a correlation between the occurrence of MD with eating behavior with PR = 2.56 and consumption of supplements with PR = 2.56. The most influential factor on MD was a social influence.

Keywords: eating behavior, fitness center, muscle dysmorphia, social influence, training load

Introduction

One of the places where people do physical exercise is at the fitness center. Fitness centers are popular among adult men because physical appearance has become an object of interest over the last years. Besides fitness and health considerations, the individuals working out in these fitness centers have another purpose.¹ A study of 12 fitness centers in Yogyakarta found that 37.5% of its subjects aged 26 to 30 years exercised in fitness centers to make their muscles bigger, 24 % of them wanted to lose weight and tighten their muscles, and 37.5% wanted to get fit.² Most adult men describe their ideal body as muscular, including prominent ab muscles, broad shoulders, and a wide chest.³ To achieve that goal, men increase their physical activities to build muscles through weightlifting and attempt to improve their body shape, as they feel unsatisfied with their bodies (body dissatisfaction). A person's dissatisfaction with their body image is related to the phenomenon of body dysmorphic disorder (BDD), and muscle dysmorphia (MD) is included in it.⁴

The incidence of MD is indicated by excessive concern about one's body being too small or not muscular

enough. There is also a compulsive desire to maintain a training schedule.⁵ Previous studies have stated that 46.2% of fitness center customers are diagnosed with MD.⁶ Men with MD are proven to have a negative body image. They dislike their bodies and worry about their weight, hip, thighs, and leg shape compared with men without MD.⁷ The incidence of MD has several impacts on the decrease of social and health functions. The affected men spend most of their time lifting weights, following strict diets, limiting social activities, or going on vacations that can reveal their body shape, such as swimming or being in the middle of a crowd.⁵

Strict diets encourage excess protein consumption and limited intake of other nutrients, particularly macronutrients such as carbohydrates and fats.⁸ Supplement consumption has also become an option to increase muscle mass and obtain the desired body shape.⁹ However, improper diet changes can affect the level of energy intake adequacy and deprive one of nutrition that can improve exercise performance.⁸ In addition, these individuals have a higher risk of behavior disorders and eating habits, such as restrictive eating, fasting, skipping meals, bingeing, purging, consuming diet pills, androgenic drugs,

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laxatives, and enema to maintain the body shape and weight.³ Extreme eating behavior changes become the main cause of eating behavior disorders and disturbing the daily diet.¹⁰ Prolonged eating behavior disorders lead to imbalances in nutrition intake and health disorders such as increased blood pressure and heart rate, bradycardia, hypothermia, salivary gland swelling, anemia, dehydration, alkalosis, and other conditions related to physical and mental health.¹¹

Further, strict diets are also balanced with overtraining in weight lifting. Continuous weight lifting is an everyday activity of fitness center members who aim to get a muscular body. Over-exercising to achieve the ideal body can degrade the immune system in addition to causing the following: chronic muscle pain, increased heart rate, decreased physical performance, muscle injuries, increased blood lactate levels, sleeping disorders, biochemical disorders, and psychological disorders such as exercise addiction and drug abuse (e.g., steroid consumption).¹² Studies also show that 3.4% of the men who lift weights in fitness centers at the frequency of six hours per week have a higher tendency of MD.⁹

The factors causing MD include biological, social, and psychological factors.¹³ One biological factor that affects muscle dysmorphia is body mass index (BMI). An underweight or overweight person tends to have negative body image and body dissatisfaction, which will motivate them to increase their muscle mass.¹⁴ Social factors that lead to MD include the influence of social media, peers, and family. Television, magazine, and other media affect body image and create unreal social comparisons, as typical male models are masculine and muscular.¹⁵ In addition, men want to be more muscular to flaunt their physical strength and get acceptance from peers. When a man successfully obtains the ideal body, that makes his friends wish to imitate him.¹⁶

Psychological factors that affect MD are self-esteem and perfectionism. One study shows that self-esteem has negative correlations with it. Someone with low self-esteem will feel unsatisfied with what they have, including body shape, which tends to cause MD.¹⁷ In addition, perfectionism results in MD when one puts in unrelenting attempts to have the perfect body shape. One study predicted that the higher the perfectionism, the higher the dissatisfaction with the existing body shape.¹⁵ Previous studies regarding the factors affecting MD and its impact discuss psychological factors primarily.^{13,15-17} However, this study would also thoroughly examine the biological aspects from the perspective of nutrition in an adult male who has newly become a member of a fitness center. This study would focus on the reasons behind the increase in men's awareness of body image and exercise to obtain a muscular body. Because there is still limited study on MD in fitness center members, the authors were interested in

conducting study on the factors affecting MD and its impact on eating behavior and exercise load in fitness center members.

Method

The scientific scope of this study was in the field of community nutrition, and so this study used a cross-sectional design. Data collection was carried out in June–August 2020 at three fitness centers in Semarang City, which are Summit Gym, Argy Gym, and Be Gym. This was an observational study with a method of taking subjects by consecutive sampling. Thus, the research subjects who met the criteria were included in the study until the requirement of a minimum of 100 subjects was fulfilled.¹⁸ The inclusion criteria in this study were men aged 17–45 years who were still actively weight training at the fitness center, had no history of serious illness, and were willing to become study subjects by filling out an informed consent. One hundred subjects met all the study inclusion criteria.

The MD was measured using the Drive Muscular Scale (DMS) questionnaire, containing 15 statements about individual perceptions and assessments of a person's body muscles.¹⁹ The DMS consisted of two factors. The first was the attitudes oriented towards gaining a muscular body, which tested a person's attitude towards muscles, such as, "I wish I were more muscular," and "I think I would feel more confident if I had more muscle mass." The second was muscle-oriented behavior, which included supplement consumption and training adherence, such as, "I use energy or supplements," and "I feel guilty if I miss my weight training schedule."²⁰ A subject was diagnosed with MD if the T-score was ≥ 50 and declared non-MD if the T-score was less than 50.¹⁹

Eating behavior was measured using the Eating Attitude Test-40 (EAT-40) questionnaire containing 40 statement items designed with modifications to assess a person's attitudes, behavior, and eating disorders. A score of more than 30 was considered an indicator of eating disorders.²¹ Exercise intensity was measured using an exercise intensity questionnaire containing questions about the type of exercise, training duration, and training frequency in the last week. Quantitative data on subject characteristics included their age, the length of their membership at the fitness center, details of the previous week's days of weight training, food and dietary restrictions, special diets, and supplement consumption.

The variable affecting MD, BMI, was obtained by dividing the body weight (in kg) with body height squared (m). In addition, social influence variables were determined using the Sociocultural Attitudes Toward Appearance Questionnaire-4 (SATAQ-4), which contained 22 questions about the internalization of body shape and the influence of media, family, and peers with a Likert scale of

1 (strongly disagree) to 4 (strongly agree). A person was counted as affected if their score was more than the mean score and not affected if it was lesser.²² Another independent variable in this study was self-esteem, obtained from the total score of each sample using the Rosenberg Self Esteem Scale (RSE) instrument, which contains ten questions with a Likert scale of 0 (strongly disagree) to 3 (strongly agree). The questions with a negative expression had the opposite score. The measurement results were categorized into low (score less than 15), moderate (score 15–25), and high (score more than 25). In addition, there was a perfectionism variable using the Measure of Constructs Underlying Perfectionism (M-CUP) instrument, which contains 47 questions with a Likert scale of 1 (strongly disagree) to 5 (strongly agree). Results were categorized into low, moderate, and high using the following conditions, respectively: $x < \text{mean} - \text{SD}$, $\text{mean} - \text{SD} \leq x < \text{mean} + \text{SD}$, and $\text{mean} + \text{SD} \leq x$.²³

The study was conducted online by recording the responses of the fitness center members using Google Forms, which contained the several questionnaires used in this study. Univariate analysis was conducted to describe the data on the subject's characteristics along with each study variable. The correlation between the MD score, eating behavior and exercise intensity, and affecting factors was tested using the Chi-squared test and

Kendall's Tau test. On the other hand, multivariate analysis was performed using multiple logistic regression tests.

Results

All of the participants (n = 100) in this study were males who were active members of fitness centers in Semarang City. The characteristics of the group are shown in Table 1. Participants were aged between 17 and 43 years, with a mean of 24 years. They did weight training for 1–3 hours a day, 2–7 times/week on average. The type of weight training set (combination, inner core, gym machine, free-weight, and upper-lower) and the recovery time varied. Most of the participants were members of the fitness centers for ≥ 18 months, with an average of 20 months. The participants regularly trained with different motivations: a hobby, fitness, keeping up with the trend and building muscles.

Based on Table 2, 61 participants (61%) suffered from MD. The highest T-score was 66, with two participants reporting that they had always thought of using steroids. Most of the participants who consumed supplements (80%) like whey protein, amino, creatine, and protein shakes, were participants with MD. Statistically, there was a correlation between MD and supplement consumption. Participants with MD have a 2.56 times higher

Table 1. Characteristics of Study Participants (n = 100)

Variable	Category	n	%	Mean±SD	Min–Max
Age (year)				23.9±5.8	17–43
Training duration (hour/day)				1.6±0.58	1–3
Length of membership (month)				20.2±22.52	1–96
Training frequency (time/week)				4.1±1.40	2–7
Muscle dysmorphia T-score				49.8± 9.99	14.7–66.2
Supplement consumption	Without supplement	45	45		
	Whey Protein	35	35		
	Amino	11	11		
	Creatine	4	4		
	Shake	5	5		
Type of training	Combination	49	49		
	Inner core	27	27		
	Training with a gym machine	3	3		
	Free-weight	20	20		
	Upper and lower body workout	1	1		
Diet	Without diet	80	80		
	OCD (Obsessive Corbuzier's Diet)	2	2		
	Low fat	6	6		
	Ketogenic	3	3		
	Carbohydrate	5	5		
	Calorie deficit	1	3		
	High protein	1	3		
Trusted food	None	28	28		
	Banana	28	28		
	Chicken egg	15	15		
	Coffee, milk	27	27		
	Meat	2	2		
Dietary restrictions	None	76	76		
	Present	24	24		

Note: SD = Standard Deviation

Table 2. Analysis of Participants' Characteristics based on Muscle Dysmorphia Status

Variable	Category	Muscle Dysmorphia Status				p-value ^a	PR
		MD (n = 61)		Non-MD (n = 39)			
		n	%	n	%		
Diet behavior	Eating disorder	36	80	9	20	0.001*	2.56
	Non-eating disorder	25	45.5	30	54.5		
Frequency of training	High	40	60.6	26	39.4	1.000	0.98
	Low	21	61.8	13	38.2		
Training duration	Long	33	62.3	20	37.7	0.944	1.05
	Short	28	59.6	19	40.4		
Special diet	With diet	14	66.7	7	33.3	0.728	1.28
	Without diet	47	59.5	32	40.5		
Supplement	With supplement	44	80	11	20	<0.001*	2.56
	Without supplement	17	37.8	28	62.2		
Trusted food	Present	47	65.3	25	34.7	0.239	1.20
	None	14	50	14	50		
Dietary restrictions	None	12	50	12	50	0.304	0.64
	Present	49	64.5	27	35.5		

Notes: *significant (<0.05), ^aChi-square test, MD = Muscle Dysmorphia, PR = Prevalence Ratio

risk of consuming supplements than those without.

A total of 80% of the participants who suffered from eating disorders had MD, significantly higher than non-MD participants (20%). This disorder was validated by a high EAT-40 score of 23.16. The positive answers were mainly recorded from participants' statements of consuming higher levels of protein compared to carbohydrates or fats and supplements. Statistical analysis showed that participants with MD have a 2.56 times higher risk of eating disorders than those without MD. Even though the results showed a shift in eating behavior, not all the participants with MD adhered to the principle of special diets such as a carbohydrate diet, a low-fat diet, Obsessive Compulsive Disorder (OCD), or a ketogenic diet. Statistically, there was no association between the occurrence of MD and a special diet among the members of the fitness centers.

Participants also consumed “trusted food”; the food they believe as the fittest food to help them reach their goals in the fitness center, before and after weight training based on information from different media or personal trainers. A total of 72% of the participants who consumed different trusted food/drinks were participants with MD, and this number was higher than the non-MD participants who consumed trusted food/drinks. The trusted food consumed by the participants included coffee, banana, egg, milk, meat, and chicken. Although most of the participants believed in particular food or drinks, only a small number of the participants with MD had dietary restrictions. Thus, there was no solid correlation between MD and the consumption of trusted foods and dietary restrictions among the members of the fitness centers.

Table 2 also shows that the members of the fitness centers mostly did high-frequency and long-duration weight training in both MD and non-MD groups. However, the bivariate analysis showed no significant association between the occurrence of MD and the frequency and duration of the training.

Table 3 shows that social influence, self-esteem, and perfectionism affect the occurrence of MD. While nutritional status is not related to the occurrence of MD, participants influenced by social life have a three times higher risk of suffering from it. The records stated that 92.2% of the socially influenced participants suffered from MD, compared to only 28.6% of the participants who were not. Additionally, there was a significant moderate correlation between perfectionism and self-esteem with the occurrence of MD. The τ -score indicated a positive correlation, where the higher the perfectionism, the higher the chance of being diagnosed with MD. On the other hand, the lower the self-esteem, the higher the likelihood of occurrence of MD.

Social influence came from media, peers, and family. Although most of the socially-influenced participants were affected by these sources, media was the most dominating (33.7%) influence due to social comparison, causing someone to compare their bodies to others. Further, televisions, magazines, the internet, movies, billboards, advertisements, videos, and other media are highly accessible in this digital era. Peer pressure came from fellow gym members who exchanged stories about different ways of getting the desired body shape. For those who were married, the influence from their spouse often came as comments on appearance. These factors resulted in the pressure to improve appearance, reduce body fat per-

Table 3. Bivariate Analysis on Factors Affecting the Occurrence of Muscle Dysmorphia

Variable	Category	Muscle Dysmorphia Status				p-value	PR	τ
		MD (n = 61)		Non-MD (n = 39)				
		n	%	n	%			
Nutritional status	Abnormal	39	63.9	22	56.1	0.588	1.13 ^a	
	Normal	22	56.4	17	43.6			
Social influence	Influenced	47	92.2	4	7.8	<0.001*	3.22 ^a	-
	Not influenced	14	28.6	35	71.4			
	Media (32.5%)							
	Family (33.6%) Peers (33.7%)							
Self esteem	Low	4	80	1	20	0.021*	-	0.229 ^b
	Moderate	57	62.6	24	37.4			
	High	0	0	4	100			
Perfectionism	High	15	76.5	4	23.5	0.003*	-	0.288 ^b
	Moderate	45	65.2	24	34.8			
	Low	5	21.4	11	78.6			

Notes: *Significant (<0.05), ^aChi-square test, ^bKendall-tau, MD = Muscle Dysmorphia, PR = Prevalence Ratio, τ = correlation coefficient of Kendall's-tau

Table 4. Factors Affecting the Most to The Occurrence of Muscle Dysmorphia

Variable	β	SE	Wald	Sig.	OR
Socially influenced	3.635	0.669	29.544	<0.001*	37.9
High perfectionism	1.600	0.557	8.26	0.004*	4.9

Notes: *Significant (<0.05), SE = Standard Error, OR = Odds Ratio

centage, and get a better body shape.

In terms of appearance, the participants enforced the impression of being neat, organized, and disciplined, and also tended to be less satisfied with their body shape. This was related to the standard nutritional status of most of the participants. Someone with normal nutritional status still had body dissatisfaction due to a high standard imposed by their perfectionism.

The variables of social influence, self-esteem, and perfectionism were further analyzed using multiple logistic regression analyses to determine the factors that affect the occurrence of MD the most. The results of the multiple logistic regression analyses are shown in Table 4. The most significant factors impacting the occurrence of MD among people who did weight training were social influence and perfectionism, with a significance of less than 0.05. Thus, it could be concluded that socially influenced people had a 38 times higher risk of MD, while those with high perfectionism had a five times higher risk.

Discussion

The participants in this study were aged between 17 and 43 years, with a mean age of 25 years. They were categorized as early adults and thus, were susceptible to

undergoing changes in values for acceptance by a specific social group. Therefore, they would try to fit in with the values adopted in their ideal social group (perfectionism).²⁴ This was in line with findings from a preceding study which reported that the higher the perfectionism, the higher chance of being diagnosed with MD among the male members of an early-adult fitness center.²⁵ The training process is progressive, which means that they start with easier workouts and finish with more difficult ones during the training. They graduated from simpler to more complex and general to specific exercises. Initially, they exercised their entire body and moved to targeted exercises. Their weights changed from light to heavy in quantity and quality consistently, progressively, and continuously.²⁶ However, the training process must be spread over a sufficient period, as the body cannot suddenly adapt to the effect of weight training. It requires process and time put in gradually and continuously.²⁷

The consumption of protein supplements in males who do weight training is believed to increase muscle size, thus increasing muscle strength and reducing body fat.²⁸ The findings of this study showed that 80% of the participants who consumed supplements (whey protein, amino, and creatine) had MD. This number is higher than the prevalence in a preceding study conducted in

Ghana that reported 33% of its participants consuming supplements.²⁹ Another study conducted in Yogyakarta also stated that 44% of the males who do weight training often consume supplements.² According to statements made by the participants, the consumption of supplements followed the recommended dosage written on the label. The main reason behind the change in the eating behavior among male members of the fitness center was the obsession to gain more muscle mass in a shorter time, explaining why they did not focus on the health aspect of consuming food.²⁸ This is following the results of this study; most of the participants preferred to consume supplements to speed up muscle gain, as bodybuilding athletes do, more than changing their eating behavior naturally.²⁹ Inadequate eating practices in men with MD affect the result of the training as well as the consumption of food supplements and the abuse of anabolic steroids, which are associated with a higher frequency disorder. Further, the lack of food intake is related to worsening psychopathologies and body disorders.⁸ An excessive consumption of supplements is harmful and may cause adverse effects such as kidney damage and other diseases. Supplements should only be an addition to complete nutrient intake in the event of inadequate levels of some nutrients.²⁹

The results of this study showed that 80% of the participants with eating disorders had MD compared to non-MD participants. People with MD were preoccupied with appearance and worried about the muscles not being large and muscular enough. These conditions led them to do activities that could build their muscles up, like weight training, dieting, and drugs.³⁰ This finding was in line with the results of a preceding study conducted in the USA among bodybuilders, in which 58.3% of the participants were diagnosed with MD.⁷ Another report stated that symptoms of MD start to manifest at the age of 19.5 years, indicated by the participants spending over three hours a day thinking of becoming more muscular, having control over their weight training activities, following disturbing diets and training, avoiding certain places and activities because of the worry over their muscle, and involving in body monitoring, such as checking out their body in the mirror frequently and wearing loose clothes to hide their body.³

This study revealed that people diagnosed with MD have a 2.56 times higher risk of eating disorders than people without MD. This data is consistent with a study stating that men with MD have a more irregular diet pattern than men without the condition.⁷ Earlier studies have also noted that changes in eating behavior often happen to sports players that pay attention to their weight, as weightlifters, gymnasts, and swimmers do.^{28,31,32} An additional study also reported a significant association between MD and eating disorders.⁷ Participants diagno-

sed with MD scored significantly higher on EAT than those without it.³² In addition to the use of supplements, weight training activists also do a diet to reduce water intake. These strategies aim to minimize subcutaneous water and optimize muscle definition. However, dehydration and sodium depletion resulting from fluid restriction is dangerous for training performance.³³ Psychologically, men with MD who do weight training non-professionally or non-competitively tend to yearn for approval or recognition for their appearance instead of their performance.³⁴ Body dissatisfaction, monitoring, and awareness are associated with irrational thoughts, perceptual distortion, and negative influences that damage a positive body image.³⁵

A study showed that those with high-intensity training scored higher in MD symptoms and related psychopathy (irregular eating pattern) compared to the control group.³⁶ Another study proposed that a higher score in MD symptoms is correlated with training addiction, based on it being high among the 151 male gym users and 25 bodybuilders part of that study.³⁷ As per this study result, a total of 30 participants stated that they often, very often, and always felt guilty if they missed their training. Even though this study reported a statistically insignificant association between the occurrence of MD and training duration and frequency, people with MD recorded a higher frequency and longer training periods than non-MD participants.

Multivariate analysis indicated that social influence was the most affecting variable in the occurrence of MD, where its risk was 38 times higher than participants who were not socially influenced. This finding agreed with a study conducted by Vitari stating that there was a significant correlation between MD and media influence due to the latter's relation with social comparison; thus, media pressure may cause someone to compare their body to others.³⁸ Social influence consists of media, parents, and peers. The media influences body image, resulting in social comparisons, with changes in perception related to the ideal body being regulated by the masculine and muscular models.¹⁵ The family environment thus becomes an important influence because comments on appearance may have positive or negative impacts.³⁹ Peers also play a role in developing body dissatisfaction because their comments on appearance directly influence their friendship. Furthermore, when someone achieves the ideal body shape, a desire to do the same will occur in their friends. This statement follows a study by Aliyev that found a strong association between media influence, parents, and peers with body image.⁴⁰ In gyms, many posters of masculine and muscular men are on display. This condition may also increase body dissatisfaction, and hence, parents must cite positive examples to their children and avoid making negative comments. Peers' in-

fluence as "role models" after achieving their goal to be muscular should help their friends succeed too.

This study also indicated a significant moderate correlation between perfectionism and MD (p -value <0.001). Perfectionism consists of a high standard, regularity, expecting perfectionism from others, perception of pressure, and reactivity to mistakes, details, evaluators, satisfaction, and dissatisfaction.¹³ This study finding was supported by a preceding study by Pratiwi, which found a positive association between perfectionism and body image dissatisfaction. Thus, the higher the perfectionism, the higher the body image dissatisfaction.²³ A study by Iswidyanti and Hamidah, which found a significant positive correlation between perfectionism and the tendency of MD in male gym users, also supports this study's findings. The higher the perfectionism level in male gym users, the higher their tendency to be diagnosed with MD.⁴¹

Perfectionism indicates a dominant high standard. It is associated with pressure from other people that seems to demand or make them often say "should be" to themselves. Perfectionism affects the occurrence of MD both indirectly and directly. The direct effect can be found in the continuous effort to achieve "the perfect body." The indirect effect comes in the form of body dissatisfaction. If their body differs even slightly from the ideal body shape, they will be dissatisfied. This situation then increases the risk of MD.¹³

The strength of this study is that it examined the factors that influence MD and analyzed its harmful effects. However, there are weaknesses in this study as well. This study has not considered other factors that influence the incidence of MD, such as the purpose of changing eating behavior, exercise motivation, and internal body orientation of fitness center members. Fitness center members require a special approach to diet management and training load, and this is needed to prevent nutritional and health problems. Further research is required to determine the other factors that influence the occurrence of MD, such as exercise motivation and internal body orientation, and to analyze their long-term health impact on people with MD.

Conclusion

Muscle dysmorphia (MD) correlates with eating behavior and consumption of supplements in fitness center members. Subjects with MD had a 2.56 times greater risk of experiencing disorders in their eating behavior and the consumption of supplements than the members without it. Social influence and perfectionism also have a relationship with the incidence of MD in fitness center members, with the most influential factor being the former. Further study is needed to see the long-term health impact on people with muscle dysmorphia.

Abbreviations

MD: Muscle Dysmorphia; DMS: Drive Muscular Scale; EAT-40: Eating Attitude Test-40; BDD: Body Dysmorphic Disorder; BMI: Body Mass Index; SATAQ-4: Sociocultural Attitudes Toward Appearance Questionnaire-4; RSE: Rosenberg Self Esteem Scale; M-CUP: Measure of Constructs Underlying Perfectionism; OCD: Obsessive Corbuzier's Diet; SD: Standard Deviation; OR: Odds Ratio.

Ethics Approval and Consent to Participate

The study received approval from the Bioethics Commission for Medical/Health Research, Faculty of Medicine, Sultan Agung Islamic University, Semarang, with the registration number: 224/VII/2020/Bioethical Commission. Informed consent was obtained from all participants before they filled out the questionnaire.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance.

Availability of Data and Materials

Data and information used as study materials were from original studies conducted by the corresponding author.

Authors' Contribution

DYF was in charge of developing the study design, providing critical reviews to the article, analyzing and interpreting the results, and article writing. NW, ERN, AR, and FFD served as critical reviewers of the paper and wrote part of it. RP was in charge of analyzing and interpreting the result. DKS and WD were in charge of collecting data and writing the article.

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