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ORIGINAL ARTICLE

A Multi-population Analysis of a Self-care Scale for Menstrual Pain;
Causal Relationships between Snacking and Menstrual Pain

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ABSTRACT

The purpose of this study was to verify the cross-validity of the "self-care scale for dysmenorrhea in young females" that we developed, to clarify the causal relationship between snacking and each of the factors with menstrual pain from the results of a multiple regression analysis of the related factors survey in the previous study (Yamamoto, 2019). The study participants were 1,000 young females who had menstrual pain and participated in this study, and 300 young females who had menstrual pain and participated in the related factors survey. Assuming that the two participant populations had the same factor structure, we performed a simultaneous multi-population analysis. Based on the multiple regression analysis of the previous study (Yamamoto, 2019), we set up a hypothesis for the causal relationship between snacking and each scale factor with menstrual pain, and then clarified the relationship using a path analysis. The results of our multi-population analysis revealed that the factor structure of the main survey and the related factors survey were equivalent, and that the self-care scale for menstrual pain could accurately measure six structural concepts even in different populations. When they ate more snacks, the 1st factor "perception of self-efficacy" decreased, which led to the 5th factor "expected level of burden needed to improve menstrual pain". It also led to the 4th factor "self-care using medicine". The more menstrual pain they had, the less of the 4th factor "self-care using medicine" they performed. It was demonstrated that the self-care scale for menstrual pain had cross-validity. The relationship between snacking and each factor with menstrual pain became clear.

＜Key-words＞
menstrual pain, self-care scale, multi-population analysis, snacking, causal relationship

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I. Introduction

The background of this research suggests that there has been a change in the life cycle of contemporary women in Japan. Due to women marrying later, giving birth later in life, and the declining birthrate, the range of time in a woman's life from menarche to giving birth has widened. Currently they experience menarche at the age of 12 on average, they give birth for the first time at 30 years old on average, and the birth rate has declined; thus, the number of menstrual discharges a woman experiences in her lifetime has increased ten times compared to women in previous generations. As the number of menstrual discharges has increased, the number of women who experience dysmenorrhea has also increased. The number of young females who complain of menstrual pain is higher than 30 years ago; possibly because they are not good at performing self-care.

Hence, we conducted the following series of studies to develop a scale for young females to help them perform self-care for menstrual pain. Based on the theory of Pender's Revised Health Promotion Model, we created a scale draft of 65 items from 10 concepts. We used the 5-step Likert scale, from selections "It is very true" to "It is not true at all". After confirming the validity of the content at an expert meeting, we conducted a pretest, a preliminary survey, the main survey, and a related factors survey, and then performed a correlation analysis, an exploratory factor analysis, and a confirmatory factor analysis to determine the criterion-related validity, the validity of the structural concept and reliability. Then, we developed a self-care scale for dysmenorrhea in young females, with 23 items and 6 factors. The six factors were as follows: the first factor was "perception of self-efficacy", the second factor was "intention to improve menstrual pain", the third factor was "self-care that can be achieved by making lifestyle changes", the 4th factor was "self-care using medicine", the 5th factor was "expected level of burden needed to improve menstrual pain", and the 6th factor was "feelings about self-care treatment" (see Table 1).

In this study, young females refer to women in their late teens and early twenties who have a stable ovulation cycle but are prone to having menstrual pain.

The survey was conducted in July 2017 on 1,000 females aged 18 to 22 who had menstrual pain. The related factors survey was conducted in March 2018 on 300 women aged 16 to 24 who had menstrual pain. The survey periods and the age groups were slightly different.

For each individual population, we confirmed the factor structure based on our confirmatory factor analysis. It was necessary to confirm that the "self-care scale for dysmenorrhea in young females" would be a practical scale because it is intended to be used by many young women. Therefore, we analyzed the main survey and the related factors survey at the same time to confirm whether or not their factor structures with the same number of factors could be reproduced in the two populations.

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<Table 1> Self-care Scale for Young Females with Dysmenorrhea

First factor: Perception of self-efficacy
1) I am someone who prefers to do things thoroughly and without delay.
2) Once I start working on something, I follow it through to completion.
3) Once I can plan things by myself, I am confident I can do them well.
7) I can achieve the things I have decided on my own.
Second factor: Intention to improve menstrual pain
34) From now on, I would like to consider my physical condition daily before my menstruation period.
33) Before my menstruation period, I would like to take agreeable treatment actions.
36) I want to continue treatment actions until I can improve my menstrual pain.
35) I would like to improve menstrual pain and enjoy my daily life more.
Third factor: Self-care that can be achieved by lifestyle changes
27) I do not eat or drink cold food so as not to cool my body during my menstruation period.
28) During menstruation, I carefully select my clothing to stay warm.
29) During menstruation, I'm engaged in light exercise to promote circulation around the pelvis.
31) I am not a picky eater. I consider nutritional balance when I eat.
30) During my menstruation period, I try to sleep for seven to eight hours to ensure I get enough sleep.
Fourth factor: Self-care using medicine
24) If I have pain, I try to take painkillers as soon as possible.
23) During my menstruation period, I try to take painkillers if I have them on hand.
25) As soon as menstrual pain appears, I try to take painkillers.
Fifth factor: Expected level of burden needed to improve menstrual pain
14) I do not want to spend time trying to improve my menstrual pain.
16) In order to improve my menstrual pain, I do not want to do anything that does not bring immediate results.
17) I do not want to spend much money trying to improve my menstrual pain.
Sixth factor: Feelings on self-care treatment
5) I want to find opportunities to try new things.
4) I try to cope with things positively, even if it is my first attempt.
6) If I decide to work through something, I prefer to start soon.
8) I think it is good to do things even if I need a lot of effort to achieve doing them.

The related factors survey showed that based on the multiple regression analysis of the previous study (Yamamoto, 2019), those who frequently snacked had a lower 1st factor "perception of self-efficacy" and a higher 5th factor "expected level of burden needed to improve menstrual pain". The more severe the menstrual pain they had, the less they performed the 4th factor "self-care using medicine". Based on these results, it became necessary to further explore the relationship between the multiple regression analysis and each factor.

We will establish a hypothesis about the causal relationship between snacking, the first, fifth and fourth factors and the degree of menstrual pain, and clarify it using path analysis.

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II. Subjects and Methods

1. Determining validity

We created a self-care scale for menstrual pain with 30 items and 6 factors from a draft that had 65 items based on the revised Pender's Health Promotion Model along with expert meetings, pretests, and preliminary research.

2. Main survey

1,000 women who had menstrual pain between the ages of 18 and 22 responded to our internet surveys, and a week later, 705 of them also responded to the retest. We confirmed a co-relationship between our scale and Yamauchi and Takama's "dysmenorrhea self-care scale for nursing students", and we confirmed its criterion-related validity. From the results of the exploratory factor analysis and confirmatory factor analysis, 23 items with 6 factors were obtained.

3. Investigation of related factors

We conducted an internet survey with women who had menstrual pain and were between 16 and 24 years old. The results of our confirmatory factor analysis obtained 23 items with 6 factors; thus, we confirmed the validity of our structural concept. The results of our multiple regression analysis of related factors suggested an association between the severity of their menstrual pain, their attempts to lose weight, snacking, irregular mealtimes, sleep, and bathing.

4. Method of analysis

1) We tried to confirm the equivalence between the main survey and the related factors survey using a multi-population analysis, and to prove that there is no bias in the responses between the main survey and the related factors survey. While considering the configural invariance and metric invariance, we plan to add equivalence constraints to the path coefficients and variance values step by step, and examine if there are any differences in factor structures based on the differences in fit indices.

2) A survey conducted by Yamauchi (2008) on premenstrual syndrome from the viewpoint of lifestyle and health behavior among adolescent women revealed that 84.8% of them ate snacks, which was the most common lifestyle habit. In addition, within their health behavior habits, taking painkillers was the most common habit, which accounted for 35.5%.

Miyazaki (2010) reported that stressed individuals thought more about sweets and had increased sensitivity to sweetnesses. -Paraphrased- Their eating habit of eating a large amount of snacks indicates a psychological state in that they feel anxious and lack self-confidence.

From the results of the literature and the multiple regression analysis of our previous

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study (Yamamoto, 2019), we established a hypothesis that states " Women who snack a lot (they eat things that they think they should usually avoid eating) have a lower perception of self-efficacy (they know they are not patient), so they had a stronger feeling that efforts to reduce their menstrual pain were burdensome. Women who felt that reducing their menstrual pain was burdensome perform self-care using medicine (because they know they are not patient). " In order to verify this hypothesis, we performed a path analysis to examine the degree of model fit indices as well as the relationship between each variable.

For the evaluation of model fit indices in structural equation modeling, we used the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), and the RMSEA (Root Mean Square Error of Approximation). The closer the GFI is to 1.0, the more explanatory the model is, and GFI ≧ AGFI. If the CFI is 0.9 or more, it is determined that the model explains the data. If the RMSEA is 0.1 or less, the model can be adopted. The significance level of the pass coefficient was set to be 5%.

Regarding statistical software, we used IBM SPSS 24.0 for windows and Amos 26.0 for the above analysis.

5. Ethical considerations

We explained the purpose of our main survey and preliminary survey on a questionnaire both orally and in written form, and conducted the surveys after obtaining consent forms from everyone. The internet surveys for the main survey and the related factors survey were consigned to separate survey companies. We created the research explanation and consent screens, and designed the system so that viewers could only respond to the surveys after they agreed to give consent. The survey started after our pledge that there was no conflict of interest with the survey companies and that the survey would not be used for purposes other than our research and that the respondents' anonymity would be maintained. The main research was carried out after obtaining consent from the Ethics Review Committee of the International University of Health and Welfare (Approval number: 14-Io-63, 15-Io-139, 17-Io-7).

III. Results

1. Factor structure of the main survey and related factors survey

We conducted a multi-population analysis simultaneously with the two groups of the main survey and the related factors survey (See Figures 1, 2, 3, and 4).

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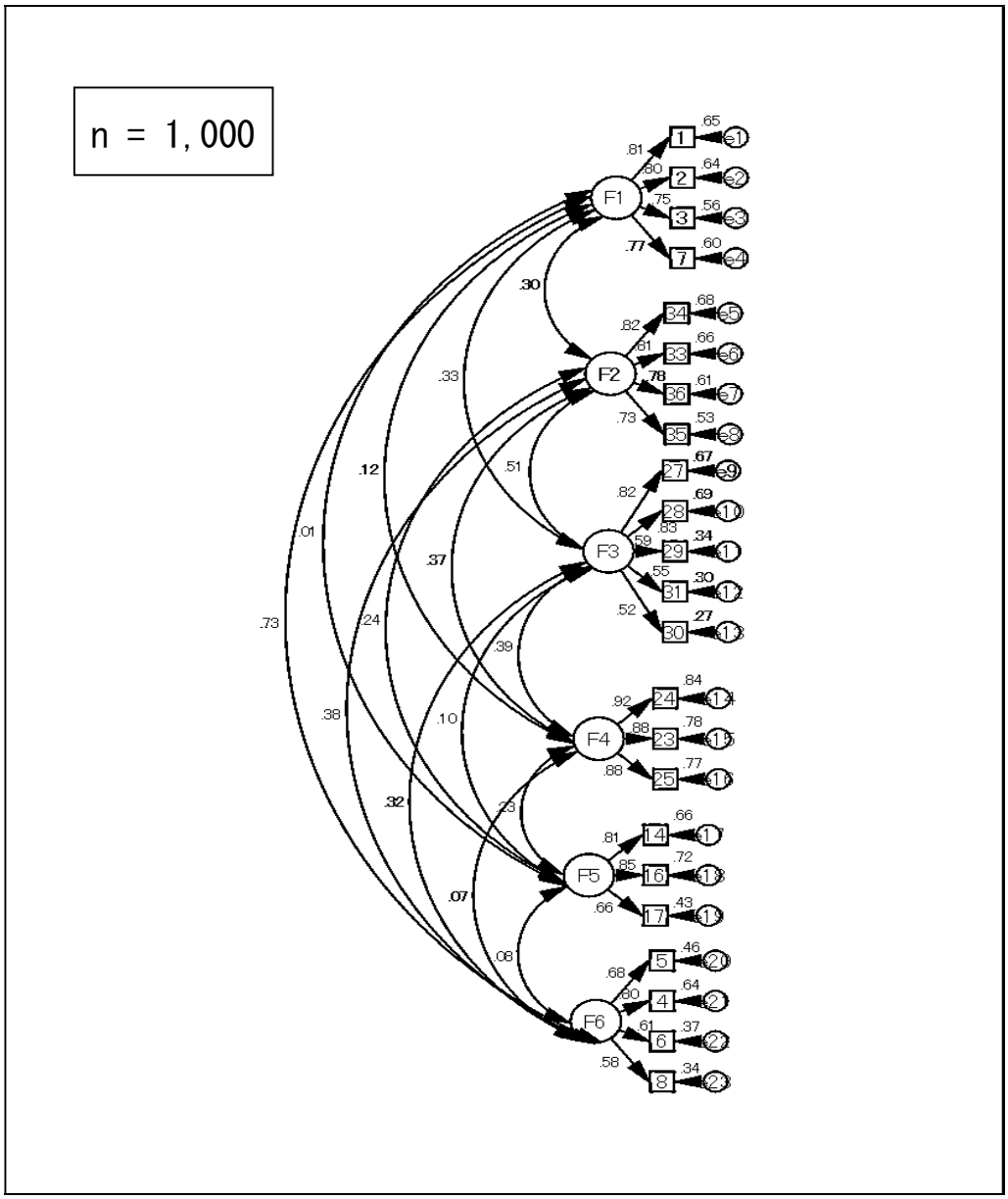

<Figure 1> Multigroup Structural equation modeling Main survey
(No equality constraint)
F1: Perception of self-efficacy, F2: Intention to improve menstrual pain,
F3: Self-care that can be achieved by lifestyle changes, F4: Self-care using medicine,
F5: Expected level of burden needed to improve menstrual pain,
F6: Feeling on self-care treatment

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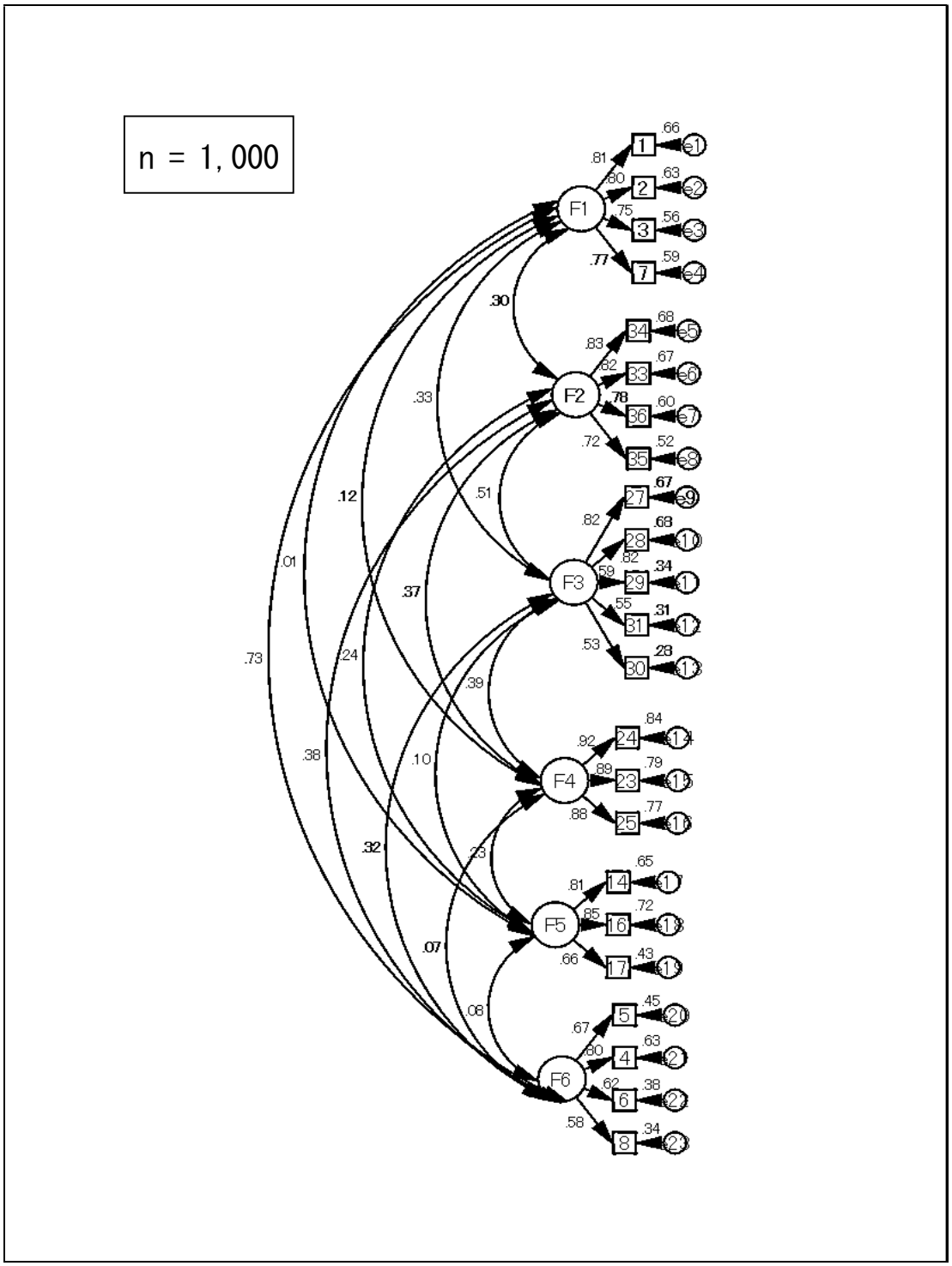

<Figure 2> Multigroup structural equation modeling Main survey
(With equality constraint)

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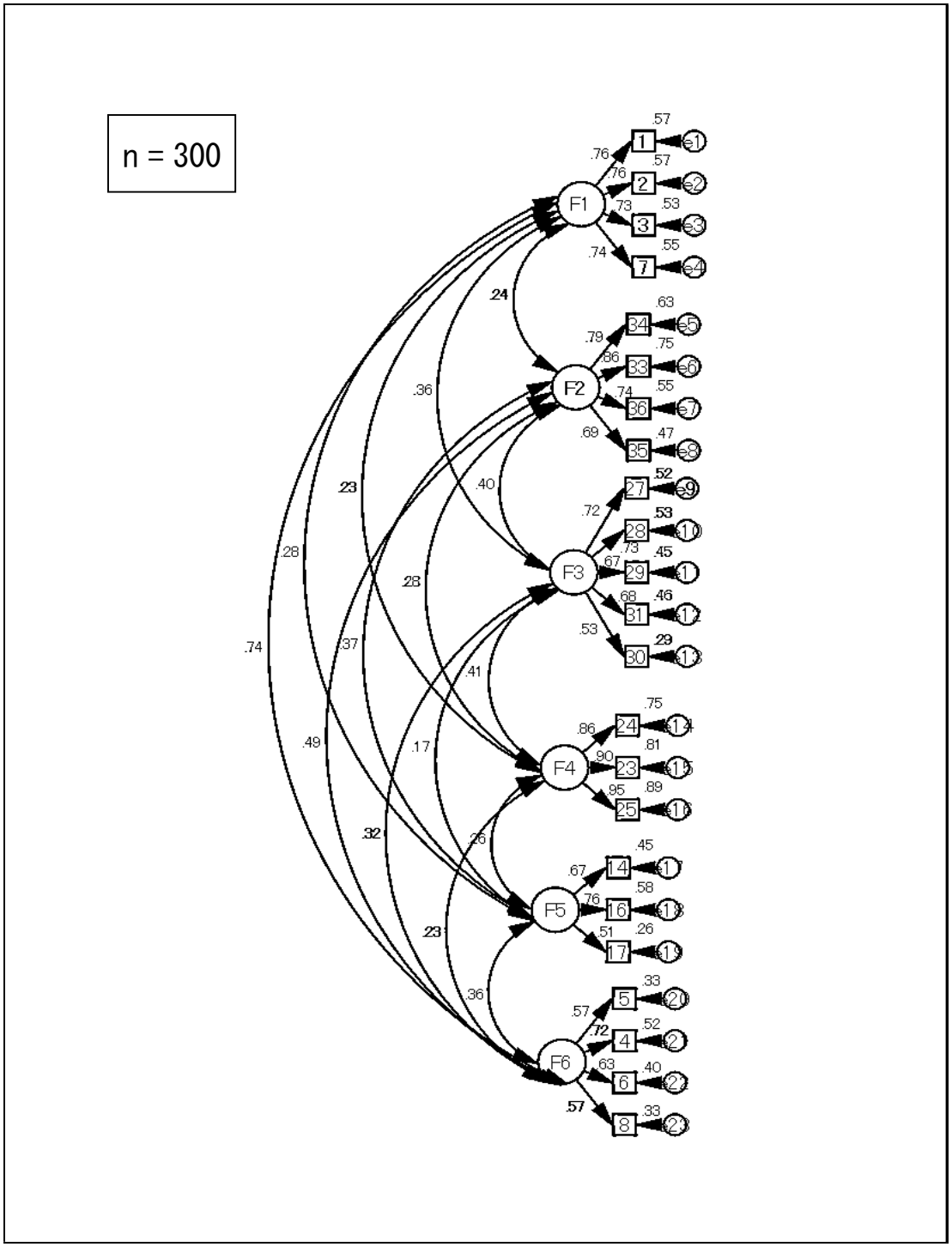

<Figure 3> Multigroup structural equation modeling Related factor survey
(No equality constraint)

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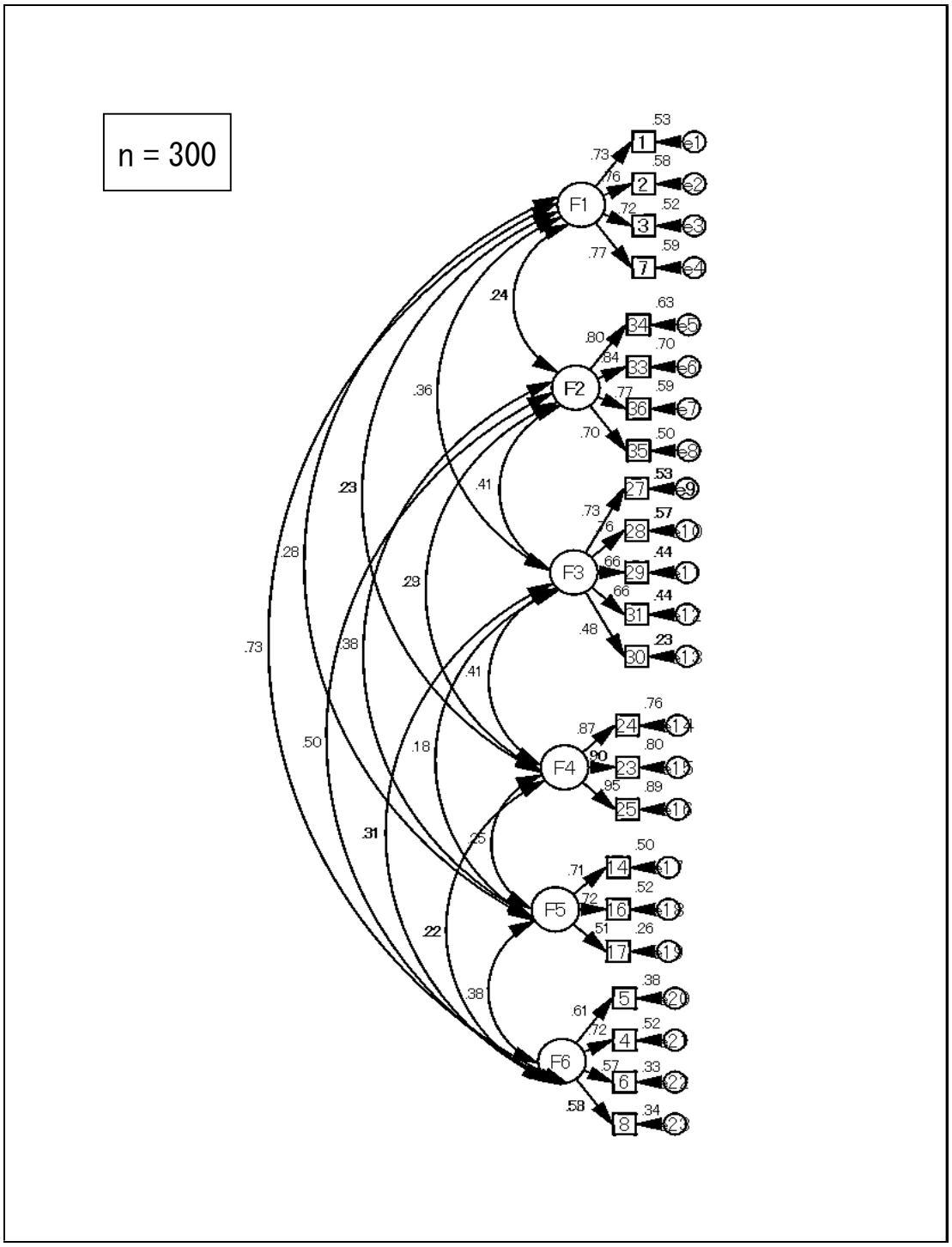

<Figure 4> Multigroup structural equation modeling Related factor survey
(With equality constraint)

The adaptation of the configural invariance model was as follows: GFI = 0.904, AGFI = 0.876, CFI = 0.928, and RMSEA = 0.043. The adaptation of the metric invariance model was as follows: GFI = 0.902, AGFI = 0.878, CFI = 0.927, and RMSEA = 0.042. It was

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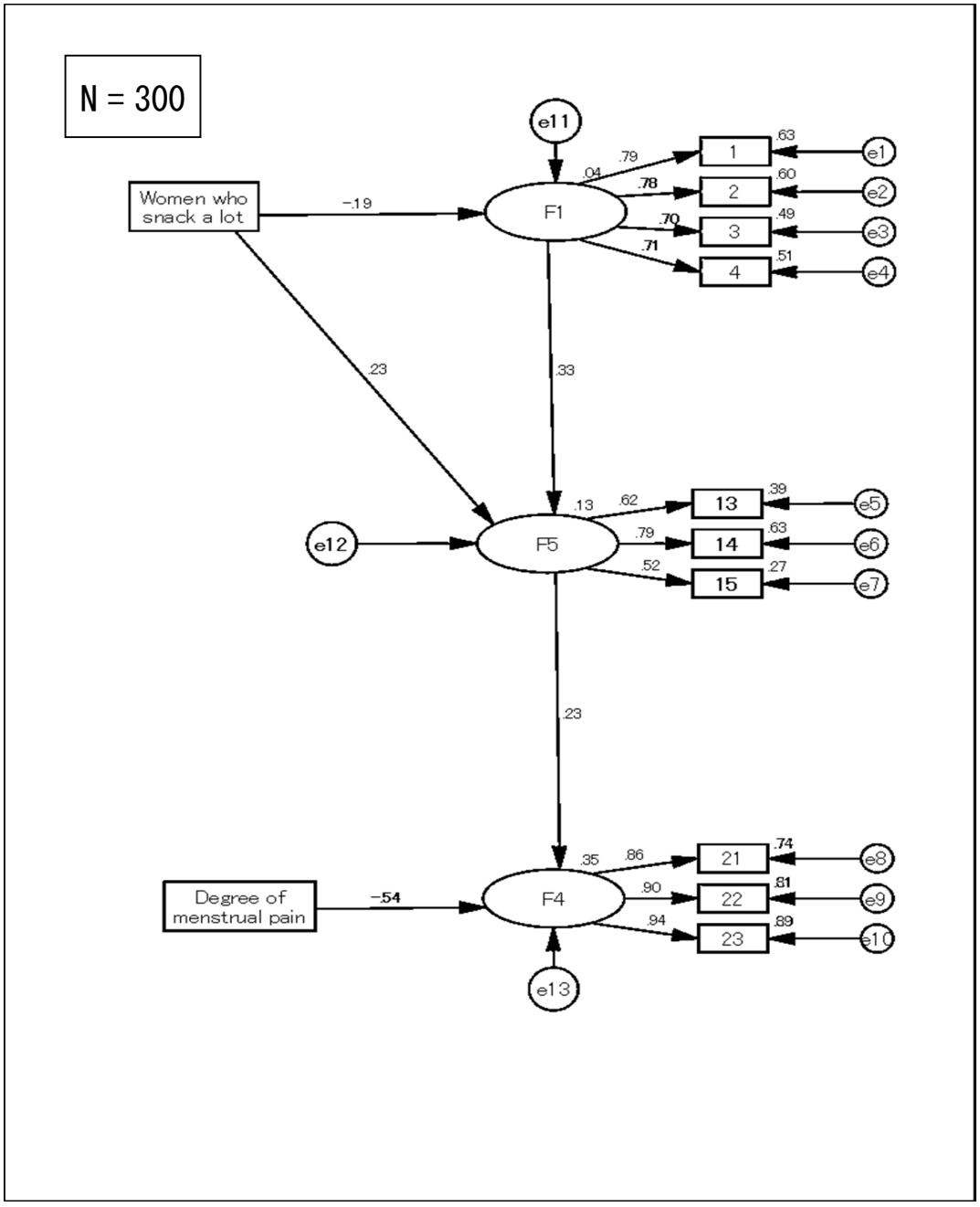
clarified that the factor structure is the same in both the main survey and the related factors survey (see Figures. 1, 2, 3, and 4), and the six structural concepts could be measured equally.

2. The causal relationship between snacking, the first, fifth and fourth factors and menstrual pain (see Figure 5)



<Figure 5> The causal relationship between snacking, the first, fifth and fourth factors and menstrual pain

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From the results of our multiple regression analysis, we established a hypothesis that states "Women who snack a lot (they eat things that they think they should avoid eating) have a lower perception of self-efficacy (they know they are not patient), so they had a stronger feeling that efforts to reduce their menstrual pain were burdensome. Women who felt that reducing their menstrual pain was burdensome perform self-care using medicine (because they know they are not patient)."

The results showed the following model fitness indices: GFI = 0.932, AGFI = 0.896, CFI = 0.950, RMSEA = 0.071, which met the statistical tolerance level.

The results of the path estimated value in Fig. 5 and its statistical significance test showed a significant relationship between "snacking a lot", the 1st factor "Perception of self-efficacy" ($\beta = -0.19$, $p < 0.01$) and the 5th factor "Expected level of burden needed to improve menstrual pain" ($\beta = 0.23$, $p < 0.01$). In addition, the 1st factor "Perception of self-efficacy" and the 5th factor "Expected level of burden needed to improve menstrual pain" ($\beta = 0.33$, $p < 0.01$) showed a significant relationship. It was also confirmed that there was a significant relationship between the 5th factor "Expected level of burden needed to improve menstrual pain" and the 4th factor "Self-care using medicine" ($\beta = 0.23$, $p < 0.01$). The degree of menstrual pain was significantly related to the 4th factor "Self-care using medicine" ($\beta = -0.54$, $p < 0.01$).

IV. Discussion

1. Factor structure of the main survey and the related factors survey

In the multi-population analysis of the main survey and the related factors survey, there were almost no effects on the path coefficient and model fitting in both the configural invariance model and the metric invariance model. The fitness was GFI $\geqq$ 0.9, and the AGFI was slightly lower than 0.9, however, GFI $\geqq$ AGFI was shown, thus, it is in an acceptable range. CFI $\geqq$ 0.9 and RMSEA $\leqq$ 0.05, so it shows good model fitness.

Regarding a multi-group analysis to prove that there is no difference in response trends between the groups when the population of two groups are different, Toyoda(2007) states that if we analyze samples extracted from multiple populations simultaneously, rather than individually, we can prove the existence of differences between populations in the entire model based on various fitness indices.

In the multi-population analysis, we examined the factor structure for equivalence between the main survey and the related factors surveys; then, we found that the factor structure of the menstrual pain self-care scale was equivalent.

In other words, there were no significant differences in the fitness indices in the multi-population analysis of 1,000 people in the main study and the 300 people in the related factors survey, so it became clear that the self-care scale for menstrual pain is a scale that can be used without differences in any population.

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2. **The causal relationship between snacking, the first, fifth and fourth factors and menstrual pain**

A survey conducted by Yamauchi (2008) on premenstrual syndrome from the viewpoint of lifestyle and health behavior among adolescent women revealed that 84.8% of them ate snacks, which was the most common lifestyle habit. In addition, within their health behavior habits, taking painkillers was the most common habit, which accounted for 35.5%. Menstruation caused stress and snacking. And it seems that they dealt with menstrual pain by internally taking painkillers.

The results of the multiple regression analysis of the previous study (Yamamoto, 2019) indicated that those who frequently snacked had a lower 1st factor "perception of self-efficacy", and a higher 5th factor "expected level of burden needed to improve menstrual pain". With regard to menstrual pain, it was shown that the more severe the menstrual pain they had, the less self-care they performed; furthermore and most significantly, they barely performed the 4th factor "self-care using medicine".

A Miyazaki's survey (2010) on the eating habits of high school and college students found that 20% of students skip breakfast while 60% of them eat snacks to fill their stomach. Furthermore, their eating habit in which they eat a large amount of snacks without having breakfast or lunch indicates a psychological state in that they feel anxious and lack self-confidence. In other words, it is inferred that there is self-distrust and anxiety among women who snack a lot, and this reduces their self-efficacy.

Based on the items of eating habits, Sumai & Taniguchi (2015) showed that there are a number of students who have the habit of snacking almost every day. Since psychological factors such as changes in the learning environment or stress have an effect on their snacking habits, it seems that psychological factors have a significant influence. It would be easy to just instruct them to stop snacking, however, this is not effective. It is important to consider their stress in the background and help them to relieve such stress. However, psychological stress varies depending on the environment they are in, so the actions they take need to change while considering their environment each time.

Reduced self-efficacy from snacking on a regular basis makes them unable to perform actions needed to improve their menstrual pain. Through their menstrual health care program (Nagatsu & Nagathuru, 2018) showed that certain changes, i.e. if women continue to develop self-care habits while also paying attention to their body and mind, then their self-efficacy improves. He states that self-efficacy is important in motivating behavioral changes. After all, it was predicted that the actions necessary to improve menstrual pain cannot be achieved unless self-efficacy improves. If they reduce their snacking and regularize the rhythm of their meals by making efforts to alleviate their psychological stress, they may get a higher sense of self-efficacy. A survey on university students conducted by Sumai & Tanigichi (2015) showed that snacking was one of the characteristics of eating habits. It is said that dietary habits are one of the factors that affects menstruation.

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Women who frequently snack come to understand that they are not patient, and they perform self-care using medicine for their menstrual pain despite their snacking. This lack of patience leads to a form of self-care which is to immediately use medicine for their menstrual pain. However, another outcome showed that the more menstrual pain they had, the less self-care they performed using drugs. According to Uemura, Sakae & Matsumura (2013), those who have severe menstrual pain have significantly higher "disastrous thinking". Based on their experiences being unable to solve their menstrual pain, they adopt "disastrous thinking" as a coping strategy, which shows how difficult it is to control menstrual pain in Japan. According to Hirata (2011), 51.3% of the women used painkillers when their pain actually appeared, and 39.7% of them thought they were ineffective. Their reluctance to use painkillers delays their chance to use them. Furthermore, it maintains that 21% of the respondents thought that "menstrual pain should be endured". According to Fukuyama (2017), some of the respondents were absent from school or work and just stayed in bed after taking NSAIDS, so it was shown that the way they were using NSAIDS may not have been appropriate. From these facts, it was shown that when women who have strong menstrual pain don't take measures and simply try to put up with the pain, they end up with stronger pain, and then even if they take painkillers after that stronger pain starts, the painkillers don't work sufficiently. Thus, even if they take painkillers, they don't feel better, so they stop taking painkillers; making it impossible for them to perform self-care using medicine. Then, it is thought that they are likely to start "disastrous thinking" because they could not cope with their menstrual pain, and they give up trying to control their menstrual pain.

Matsumoto (2004) maintains that promoting self-care for menstrual pain and other concomitant menstrual symptoms that cause a significantly negative image towards menstruation may help women to accept themselves as women, establish gender identities, and also establish individual identities. Menstruation occurs every month, so it is important for individuals to perform self-care for it. According to Nagatsu, et al. (2012), it became clear that 30% of women who have severe menstrual pain took painkillers after they felt that they couldn't put up with the pain anymore. It is also important to provide guidance on how to effectively take medicine at the right time. Furthermore, Yamasaki & Douchi (2011) maintain that for women who have strong menstrual pain in every cycle, it is recommended that medicine should be taken at the beginning of their menstruation or immediately before it starts, because prostaglandin secretion can be suppressed earlier, resulting in a higher analgesic effect.

As a form of self-care, they need to take painkillers for menstrual pain as soon as possible before the pain appears.

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V. Conclusion

1. The results of this multi-population analysis showed that the factor structure of the main survey and the related factors survey are equivalent, and the self-care scale for menstrual pain can also be used in other populations.
2. When they ate more snacks, the 1st factor "perception of self-efficacy" decreased, which led to the 5th factor "expected level of burden needed to improve menstrual pain". It also led to the 4th factor "self-care using medicine". The more menstrual pain they had, the less of the 4th factor "self-care using medicine" they performed.
3. It is important for females who snack a lot to reduce their psychological stress and improve their self-efficacy.
4. For females who have strong menstrual pain, it is recommended that they take painkillers before the pain begins.

Acknowledgment

This study is to be added and revised to the paper which was partly presented at the 6th International Research Conference of the World Academy of Nursing Science.

We declare that there are no conflicts of interest associated with this manuscript.

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