

Reliability and Validity of a Nutrition Self-Efficacy Scale

Catherine L. S. Arnold, MS, EdD, RDN

Professor
Department of Nutrition
Benedictine University
Lisle, IL, USA

Abstract

Self-efficacy is a powerful predictor for some health behaviors. The purpose of this study was to examine the reliability and validity of a nutrition self-efficacy scale measuring knowledge, skills, and motivation associated with low-fat eating. The self-administered surveys were completed by 263 university students. The Nutrition Self-Efficacy Scale and subscales demonstrated high reliability. The results of the profile analysis were consistent with theory, providing support for scale validity. Measuring outcomes beyond knowledge can demonstrate the impact of nutrition curriculum and interventions.

Key Words: self-efficacy; stage of change; dietary fat; reliability; profile analysis

1.0 Introduction

“Self-efficacy is the belief in one’s own ability to successfully accomplish something” (Bandura, 1977). Those with higher efficacy are more likely to view themselves as capable of mastering challenging tasks. Self-efficacy is a greater predictor of academic performance, particularly among the low achievers, than self-concept of ability (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). It is also a powerful predictor for health behaviors. For example, Chang, Brown, Baumann and Nitzke (2008) and Robichaud-Ekstrand (2018) found that low-income women with higher self-efficacy were more likely to use low-fat substitution behaviors. Self-efficacy has explained more than 50% of the variability in some studies (AbuSabha & Achterberg, 1997). Tighe, Woodward, and Ball (1997) found self-efficacy to be a strong predictor of dietary fat intake. Liou (2004) found self-efficacy accounted for 33% of the variability in a study on fat-related behaviors. Other researchers (DeWolfe & Shannon, 1995; Turner-McGrievy & Campbell, 2009) found that the self-efficacy to lower dietary fat was higher after completing a nutrition course. To change behaviors, one must be confident in his or her skills and have the self-efficacy that these skills can result in positive outcomes, or one may lack motivation to act. The person most likely to engage in preventative behaviors is someone with the self-efficacy to act who perceives him or herself at risk (Schafer, Schafer, Bultena, & Hoiberg, 1993). Self-efficacy demonstrates specificity, varying according to task and situation (Bandura, 1977; Bandura et. al., 1996).

The Transtheoretical Model of Behavior Change, postulated by Prochaska and DiClemente (1982) in the early 1980s, outlines a series of sequential stages for intentional health behavior change. Results of cross-sectional and longitudinal studies demonstrate that individuals progress through a series of stages as they strive to eliminate problem behaviors. Defined as the "temporal dimension of motivational readiness to change a health behavior" (Green, et. al., 1999), it is a "framework for approaches to accelerating the rate of behavior change in a population" (Greene, Rossi, Reed, Willey, & Prochaska, 1994).

The stages of the Transtheoretical Model include precontemplation, contemplation, preparation, action, maintenance, and termination. The first three stages of precontemplation, contemplation, and preparation are pre-action cognitive or “thinking” stages, while the latter stages are the action or "doing" stages. Each of these sequential stages of change have been described by a particular set of behaviors and thoughts.

In the progression from precontemplation to action, the perceived barriers to change decrease while perceived benefits and self-efficacy or confidence increase. Ounpuu, Woolcott, and Greene (2000) found that self-efficacy scores of dietary fat intake were lower in those persons in the pre-action stages of change, as compared with those in the action stages. The action stage is marked by overt consistent behavior change at a criterion level to sufficiently decrease disease risk. Success is characterized by the behavior change occurring most of the time. It is estimated that only 20% of people who come for nutrition counseling are in one of the action stages “ready” to change (Byrd-Bredbenner & Finckenor, 2000).

The primary objectives of this study were to examine (a) the reliability of the nutrition self-efficacy scale using PCA and Cronbach α , and (b) the construct validity of the scale using a profile analysis. It is hypothesized that the nutrition self-efficacy scale for lowering dietary fat will differentiate across (a) levels of dietary fat intake and (b) the stages of change in a manner consistent with the findings of other researchers.

2.0 Methodology

2.1 Participants

Data from 263 participants are included in this study. Participants were from four undergraduate nutrition courses in two universities located in the Midwest. All students in each of the classes were asked to participate, unless under 18 years of age. The mean age was 20.6 years ($sd = 2.72$), with a range of 20 from 18 to 38 years of age. The majority (77.2%) of respondents were female. Most (71.9%) participants classified their ethnicity as White non-Hispanic, 12.2% as Black or African American, 9.5% as Asian, 5.3% as Hispanic or Latino, and 1.1% as Native Hawaiian or Pacific Islander. Using a single question to mark stage, students identified themselves as predominately (85%) in the pre-action stages of change, with 25.9% in precontemplation, 17.3% in contemplation, and 42.0% in preparation. Of those in the action stages, 4.7% were in the action stage and 10.2% in maintenance.

2.2 Procedures

This was a descriptive study employing self-administered survey methods. The Institutional Review Boards of both Universities granted approval (exempt). During the first week of each of the designated nutrition courses at both of the universities, the researcher of this study recruited study participants during the class periods. Informed consent was obtained from all participants. The surveys were completed and collected during class time. Participants were entered in a raffle for the opportunity to win a \$50 cash prize as incentive to complete the surveys.

2.3 Variables and Measures

Nutrition Self-Efficacy Scale. The Nutrition Self-Efficacy Scale is a 16-item scale employing an eight-point rating system from (1) "not at all confident" to (8) "100% confident". The belief statements begin with the statement "I am confident in my ability to:" The researcher of this study developed nutrition specific statements to represent the dietary fat intake subscale. Question choice was based on field experience, review by peer practitioners, and review of existing literature. The survey tool was pilot tested twice for readability, directions, format, and content prior to use in this study; internal reliability was high.

Block Fat Screener. The researcher purchased a license for use of the Block Fat Screener (<http://www.nutritionquest.com>). Block, Gillespie, Rosenbaum, and Jenson (2000) reported that, of subjects with a “very high fat intake” measured by the Fat Screener, the majority (88%) consumed greater than the desirable 30% of fat from calories. The Fat Screener was scored and interpreted according to the guideline provided with the Screener: (a) a score of 0 to 7 meant a probable dietary fat intake at < 25% of calories from fat, (b) a score of 8 to 14 meant a probable dietary fat intake between 30 and 35% of calories from fat, (c) a score of 15 to 22 meant a person likely consumed higher than 35% of calories from fat, and (d) scores ≥ 23 were interpreted as a probable intake of 40 to 50% of calories from fat. Most respondents (59.3%) in this study had scores of ≥ 23 . A Cronbach α reliability analysis examined the internal reliability associated with the use of the Block Fat Screener for this study; reliability was acceptable at .77.

Stage of Change Question. Respondents were asked to rate their intent to adhere to a low-fat diet using a single question: “Which one of the following best describes your overall position on low-fat eating?”

The response choice set, listed in the Table 1, was developed using descriptors of the stages provided in the literature (Prochaska & Norcross, 2001) and by adapting examples of others (Byrd-Bredbenner & Finckenor, 2000; Greene & Rossi, 1998; McDonnell, Roberts, & Lee, 1998; Prochaska et. al., 1994; DiClemente, Delahanty, Havas, & Van Orden, 2015). Responses were collapsed from eight into the five categories (i.e., stages) for data entry and analysis.

2.4 Statistics

All data from the questionnaires were coded and entered into SPSS (SPSS, Chicago, IL) statistical software for analyses. Demographic data was described using frequency distributions. Cronbach α and principal components analysis were used to establish internal reliability. The profile analyses were computed using repeated measures MANOVA test (Bonferroni adjustment): within subjects = three subscales of nutrition self-efficacy; between subjects = five stages of change responses, three fat score levels. The contrasts were done by writing the commands in the SPSS syntax editor.

3.0 Results

Linearity was tested by computing a Pearson r correlation coefficient. The dependent or outcome variables of self-efficacy in nutrition skills, self-efficacy in nutrition knowledge, and self-efficacy in motivation to act, all demonstrated significant associations with each other; Pearson r values ranged from .59 to .74. Some degree of correlation was preferred in order to conduct the profile analyses.

3.1 Nutrition Self-Efficacy Scale

After pre-analysis of the data set, an item analysis was performed on the nutrition self-efficacy scale to determine degree of relationships between items. Typically, items within a subscale that do not correlate, or that have primarily weak but statistically significant correlations of $< .30$ are to be removed; no items needed removal.

A principal components analysis (PCA) with varimax rotation was computed on the Nutrition Self-Efficacy Scale. The KMO of 0.92 made the data appropriate for PCA. Bartlett's test was significant ($p < .01$), so there are correlations between variables. Factor components with eigenvalues greater than 1 were retained; three factors had eigenvalues greater than 1. According to Ling and Horwath (2001), items may be retained as part of the same scale if the items load at $\geq .40$ on one component (19). Although all 16 of the nutrition self-efficacy items loaded at $> .63$ on the 1st component of the unrotated component matrix, the results of the PCA found that the Nutrition Self-Efficacy Scale was composed of three subscales: nutrition knowledge, nutrition skills, and nutrition motivation. A one-factor solution was unacceptable, as it accounted for only 28.90% of the variance. The three-factor solution shown in Table 2 accounted for 75.90% of the variance. The scree plot also suggested a three-factor solution. Cronbach α was computed for the overall scale and each individual subscale. The internal reliability of the overall and subscales of nutrition skills, knowledge, and motivation was excellent at .95, .93, .92, and .93, respectively.

3.2 Profile of Nutrition Self-Efficacy across Levels of Fat Intake

To test the "levels hypothesis," the between group differences on the combined dependent variables were examined in the Multivariate Test table. The combined group (representing fat levels) was statistically significant, $F(2,245) = 11.48, p < .01, \eta^2 = .09$.

To test the "parallelism hypothesis", differences among profiles were examined. The result was not statistically significant, $F(4,490) = .60, p = .66$. Therefore, the levels of fat intake do not differ significantly in their profile of self-efficacy; the profiles are parallel. Refer to Figure 1 for the profile pattern.

The test for flatness was significant, Hotelling's $s = 0.205, F(2,244) = 25.01, p < .01$, with a high effect size of $\eta^2 = .17$. Thus, the means are not the same across the measures. Because an effect was found, seven contrasts were computed. Six of seven contrasts were statistically significant. Each level significantly differed from its the nearest level. The greatest effect size was found for the contrast "very high fat intake vs. others." Refer to Table 3.

3.3 Profile of Nutrition Self-Efficacy across Stages of Change

To test the "levels hypothesis," the between group differences on the combined dependent variables were examined in the Multivariate Test table. The combined group (representing stage of change) was statistically significant, $F(4,250) = 16.42, p < .01$, with a high effect size of $\eta^2 = .21$.

To test the “parallelism hypothesis”, profile differences were examined. The result was not statistically significant, $F(8,500) = 1.54, p = .14$. Thus, the stages of change do not differ significantly in their profile of self-efficacy; the profiles are parallel. Refer to Figure 2.

The test for flatness was significant, $F(2,249) = 21.27, p < .01$, with a high effect size of $\eta^2 = .15$. We reject the null hypothesis that the profiles are flat; the means are not the same across the measures. Because an effect was found, 11 contrasts were computed. Eight of 11 contrasts were statistically significant. Each stage significantly differed from the others as a whole, with large sizes found for the contrasts “preparation vs. others” and “maintenance vs. others.” Each stage did not necessarily differ from its the nearest stage. The greatest effect size ($\eta^2 = .16$) was found for the contrast “pre-action vs. action stages.” Refer to Table 4.

4.0 Discussion

In contrast with others, this study examined self-efficacy for low-fat eating in three areas (i.e., knowledge, skills, and motivation) providing a deeper examination of self-efficacy than when using a brief scale. The self-efficacy instrument demonstrated very strong reliability based on the inter-item analysis, principal components analysis, and Cronbach α . Paired t -tests demonstrated significant differences ($p < .01$) between each of the individual nutrition self-efficacy subscales. Participants reported highest self-efficacy in nutrition knowledge ($m = 4.67, sd = 1.40$), lower efficacy in motivation ($m = 4.28, sd = 1.55$), and “fair confidence” in skills ($m = 3.96, sd = 1.56$). The profile analysis provided support for construct validity. The profiles patterns of knowledge > motivation > skills for the nutrition self-efficacy subscales were similar across both the levels of dietary fat intake and the stage of change classifications. Refer to Figures 1 and 2.

The means for the nutrition self-efficacy subscales appropriately varied across stages of change and fat intake levels, providing additional validation for the tool. Consistent with findings by DeWolfe and Shannon (1995), the findings of this profile analysis revealed that respondents with higher self-efficacy consumed lower dietary fat. Only those with a moderate intake of fat or less reported an efficacy score of 5.0 or greater, representing “confident.” Those with lower self-efficacy scored higher on the Block Fat Screener, indicating a higher intake of dietary fat.

In agreement with the findings of Ounpuu, Woolcott, and Greene (2000) and DiClemente et. al. (2015), this study found a clear differentiation ($p < .01$) of large effect in nutrition self-efficacy between the action stages and the pre-action stages in university students; those in the action stages of change for dietary fat intake tended to have higher nutrition self-efficacy than those in the pre-action stages of change. Consistent with the findings of Sporny and Contento (1995), individuals in the contemplation stage in this study had lower self-efficacy than those in the precontemplation stage, although the difference was not statistically significant. This study found that the scores for those in the preparation stage did not differ from those in the action stage, but did significantly differ from the combined action stages and from “others” as a group. Similar to Sporny and Contento (1995), this study found that participants in the maintenance stage scored higher on self-efficacy than other stages. However, this study found the maintenance stage did not significantly differ from the action stage.

An increase in self-efficacy for exercise across the stages of change was reported by Callaghan Eves, Norman, Chang, and Lung. (2002), although differences between stages were not reported. Tung, Gillett, and Patillo (2005) found those in the action stages of physical activity to have higher self-efficacy, as compared to the pre-action stages. Keller, Nigg, Jakle, Baum, and Basler (1999) reported this pattern of self-efficacy distribution across the stages in a study about smoking behaviors, with a significant difference in self-efficacy between the pre-action and action stages. Other researchers confirmed a positive correlation between self-efficacy and stage of change (Campbell et. al., 1998; Cox, Stimpson, Poole, & Lambur, 2003). The differences in level of significance between this study and that of other researchers may be attributed, in part, to differences in the use of a single question to identify stage of change, the population studied, and/or the domain specificity of self-efficacy.

4.1 Implications for Research and Practice

The majority of the university students in this study were in a pre-action stage. To effect behavior change in these students, attention should be given to identifying risk behaviors and consequences of unhealthy nutrition habits, discussing benefits to adopting healthy eating as a lifestyle change, provision of “how-to” tips for change, and using methods to increase self-efficacy - such as personal mastery, vicarious experiences, social persuasion, and eventually promotion of goal setting.

This “staged” approach may be more effective than traditional lecture methods in promoting acquisition and practice of healthy eating behaviors while enabling knowledge gain. Additionally, measuring outcomes beyond knowledge can demonstrate the impact of the nutrition curriculum.

References

- AbuSabha, R., & Achterberg, C. (1007). Review of self-efficacy and locus of control for nutrition- and health-related behavior, *J Am Diet Assoc*, 7 (97), 1122-1132.
- Armitage, C.J., Sheeran, P., Conner, M., & Arden, M.A.. (2004). Stages of change or changes of stages?: Predicting transitions in Transtheoretical Model in relation to healthy food choice. *J Consult Clin Psychol*, 72, 491-499.
- Bandura, A. (1997). *Self-efficacy: The Exercise of Control*. New York: H. W. Freeman
- Bandura, A., Barbaranelli, C., Caprara, G.V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Dev*, 67, 1206-1222.
- Block, G, Gillespie, C, Rosenbaum, EH, & Jenson, C. (2000). A rapid food screener to assess fat and fruit and vegetable intake. *Am J Prev Med*, 18, 284-288.
- Byrd-Bredbenner, C., & Finckenor, M. (2000). Putting the Transtheoretical Model into practice with Type 2 Diabetes Mellitus patients. *Topics in Clinical Nutrition*, 15, 44-58.
- Callaghan, P., Eves, F.F., Norman, P., Chang, A.M., & Lung, C.Y. (2002). Applying the Transtheoretical Model of change in young Chinese people. *Br J of Health Psychol*, 7, 267-282.
- Campbell, M.K., Symons, M., Demark-Wahnefried, W., Polhamus, B., Bernhardt, J.M., McClelland, J.W., & Washington C. (1998). Stages of change and psychosocial correlates of fruit and vegetable consumption among rural African-American church members. *Am J Health Promotion*, 12, 185-191.
- Chang, M-W., Brown, R.L., Baumann, L.J., & and Nitzke, S.A. (2008). Self-efficacy and dietary fat reduction behaviors in obese African-American and White mothers. *Obesity*, 16, 992-1001.
- Coulson, N.S. (2000). An application of the stages of change model to consumer use of food labels. *Br Food J*, 102, 661-668.
- Cox, R.H., Stimpson, T.S., Poole, K.P., & Lambur, M.T. (2003). Physical activity characteristics of potential participants in nutrition and fitness programs based on stages of change, self-efficacy, and decisional balance. *Family & Consumer Sciences Research Journal*, 31, 361-377.
- DeWolfe, J.A., & Shannon, B.M.. (1995). Factors affecting fat consumption of university students: Testing a model to predict eating behavior change. *J Am Diet Assoc*, 54, 132-137.
- DiClemente, C., & Prochaska, J. (1982). Self-change and therapy change of smoking behavior. A comparison of processes of change of cessation and maintenance. *Addict Behav*, 7, 133-142.
- DiClemente, C.C., Delahanty, J.C., Havas, S.W., & Van Orden, O.R.(2015). Understanding self-reported staging of dietary behavior in low-income women. *Journal of Health Psychology*, 20 (6) 741-753.
- Greene, G., Rossi, S., Rossi, J., Velicer, W., Fava, J., & Prochaska, J. (1999). Dietary applications of the stages of change model. *J Am Diet Assoc*, 99, 673-678.
- Greene, G.W., & Rossi, S.R. (1998). Stages of change for reducing dietary fat intake over 18 months. *J Am Diet Assoc*, 98, 529-536.
- Greene, G.W., Rossi, S.R., Reed, G.R., Willey, C., & Prochaska, J.O. (1994). Stages of change for reducing dietary fat to 30% of energy or less. *J Am Diet Assoc*, 94, 1105-1113.
- Keller, S., Nigg, C.R., Jakle, C., Baum, E., & Basler, H.D. (1999). Self-efficacy, decisional balance and the stages of change for smoking cessation in a German sample. *Swiss J Psychol*, 58, 101-110.
- Ling, A.M.C., & Horwath, C. (2001). Perceived benefits and barriers of increased fruit and vegetable consumption: Validation of a decisional balance scale. *J Nutr Educ*, 33, 257-265.
- Liou, L. (2004) Influence of self-efficacy on fat-related dietary behavior in Chinese Americans. *The International Electronic Journal of Health Education*, 7, 27-37.
- McDonnell, G.E., Roberts, D.C.K., & Lee, C. (1998). Stages of change and reduction of dietary fat: Effect of knowledge and attitudes in an Australian university population. *J Nutr Educ*, 30, 37-43.

Ounpuu, S., Woolcott, D.M., & Greene, G.W. (2000). Defining stage of change for lower-fat eating. *J Am Diet Assoc*, 100, 674-679.

Prochaska, J.O., & Norcross, J.C. (2001). Stages of Change. *Psychother*, 38, 443-448.

Prochaska, J.O., Velicer, W.F., Guadagnoli, E., & Rossi, J.S. (1994). Patterns of change: Dynamic typology applied to smoking cessation. *Multivariate Behav Res*, 26, 83-107.

Robichaud-Ekstrand, S. (2018). Maintenance self-efficacy beliefs predict dietary fat reduction habits in individuals with coronary artery disease and/or diabetes. *Canadian Journal of Cardiovascular Nursing*, 28 (2), 3-9.

Schafer, R.B., Schafer, E., Bultena, G.L., & Hoiberg, E.O. (1993). Food safety: An application of the health belief model. *J Nutr Educ*, 25, 17-24.

Sporny, L.A., & Contento, I.R. (1995). Stages of change in dietary fat reduction: Social psychological correlates. *J Nutr Educ*, 27, 191-199.

Tighe, C.M., Woodward, D.R., & Ball, P.J. (1997). The association between fat intake and self-efficacy depends on the value placed on health [Abstract]. In: *Symposium of the Nutrition Society of Australia*.

Tung, W.C., Gillett, P.A., & Pattillo, R.E. (2005). Applying the Transtheoretical Model to physical activity in family caregivers in Taiwan. *Public Health Nursing*, 22, 299-310.

Turner-McGrievy, G.M., & Campbell, M.K. (2009). Nutrition information to the desktop: A pilot online nutrition course on saturate fat for public librarians increases knowledge, expectancies, and self-efficacy. *Journal of Nutrition Education and Behavior*, 41, 3, 188-193.

Table 1
Stage of change question response choice key

Stage of Change Question Response Choices	Stage
a. I have been regularly eating a low-fat diet for <i>greater than 6 months</i> .	Maintenance
b. I have been regularly eating a low-fat diet, BUT for <i>less than 6 months</i> .	Action
c. I have <i>tried</i> to consume a low-fat diet with some success in the past 12 months OR I definitely plan to change my diet to low-fat in the <i>next 30 days</i> .	Preparation
d. I have <i>tried</i> to make changes towards eating a low-fat diet in the past 12 months but was not successful OR I definitely plan to change my diet to low-fat in the <i>next 30 days</i> .	Preparation
e. I may have read articles about low-fat eating, but I am not intentionally eating a low-fat, BUT I am <i>considering</i> changing my diet to low-fat in the <i>next 6 months</i> .	Contemplation
f. I am not intentionally eating a low-fat diet, AND I have <i>no plans to change</i> my diet to low-fat in the next 6 months.	Precontemplation
g. I never considered changing my diet to low-fat	Precontemplation

Table 2
Nutrition self-efficacy scale, principal components factor loading matrix

	1	2	3
I am confident in my ability to:			
Nutrition Self-Efficacy (Skills)			
Alter a recipe to make it lower in fat	.86		
Prepare/cook foods using low-fat methods	.85	.31	
Write a low-fat menu	.81		
Teach a friend or family member how to lower the fat in his or her diet	.73	.38	
Keep track and monitor the level of fat in diet	.67	.38	.38
Use the food label to calculate percent fat in food item	.65		
Make time to shop and prepare low-fat foods	.57	.33	.49
Nutrition Self-Efficacy (Knowledge)			
Identify foods high in fat	.32	.82	
Identify foods low in fat	.32	.82	
Identify low-fat from a restaurant or cafeteria menu	.35	.77	
Identify foods high in saturated fat	.31	.76	
Identify low-fat food choices at a party or celebration	.41	.74	
Identify my own risk factors		.65	
Nutrition Self-Efficacy (Motivation)			
Motivate myself to self to stick to a low-fat diet on a regular basis			.86
Motivate myself to self to stick to a low-fat diet when temptation for eating high-fat food arises			.86
Set and meet goals for reducing the fat in my diet			.84
<i>Note: Values < .3 suppressed in table</i>			

Table 3
Levels of fat intake contrasts

Fat Intake Levels Contrasted	<i>F</i>	<i>p</i>	η^2
Moderate fat vs. others	12.82	<.01	.05
High fat vs. others	0.33	.57	<.01
Very high fat vs. others	22.74	<.01	.08
Moderate vs. High fat	6.07	.01	.02
Moderate vs. Very high fat	19.42	<.01	.07
High fat vs. Very high fat	7.86	.01	.03
Moderate vs. Combined high & very high fat	12.82	<.01	.05

Table 4
Stage of change contrasts

Stages Contrasted	<i>F</i>	<i>p</i>	η^2
Maintenance vs. others	35.84	<.01	.12
Action vs. others	5.25	.02	.02
Preparation vs. others	39.85	<.01	.14
Contemplation vs. others	105.98	<.01	.09
Precontemplation vs. others	16.77	<.01	.06
Contemplation vs. precontemplation	4.61	.29	<.01
Preparation vs. contemplation	18.40	.04	.02
Preparation vs. precontemplation	1.20	.27	<.01
Action vs. preparation	35.59	<.01	.03
Maintenance vs. action	1.96	.16	<.01
Action/maintenance (“action”) vs. preparation/ precontemplation/contemplation (“pre-action”)	48.55	<.01	.16

Figure 1
Profile for dietary fat intake parallelism hypothesis

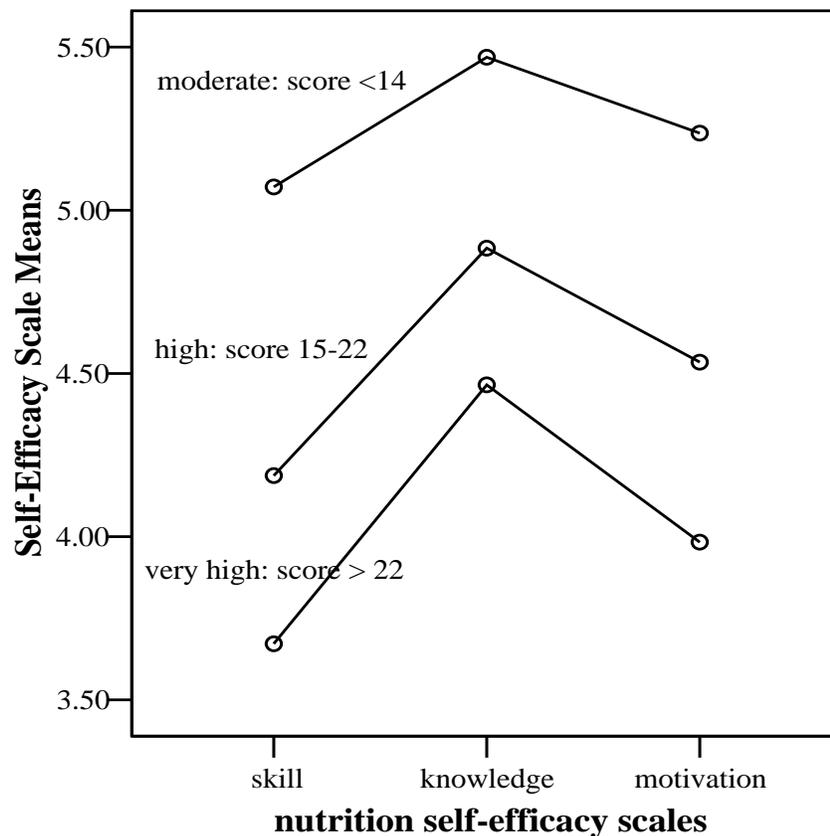


Figure 2
Profile for stage of change parallelism hypothesis

