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# Reliability of Nutriatlet Application as Dietary Assessment Method for Athlete

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***Abstract*—Nutrition intake assessment needed as an early detection of athletes' nutrition problems. Therefore, it was required the modification of conventional consumption survey method to obtain nutrition intake data fast and reliable. The objective of study was to test suitability of consumption survey with "Nutriatlet" application and 24-h recalls. Consecutive 7-day consumption survey has conducted to 59 martial arts athletes. 24-h recall done by nutritionist, while Food record with "Nutriatlet" done by athlete themself. Conformity test of 2 methods done with kapa and Bland Altman. Kappa value was 0.92 (p<0.0001) showed Nutriatlet application reliable as a survey instrument of consumption.**

***Keywords—"nutriatlet", dietary assessment, athlete***

## I. INTRODUCTION

The success of an athlete in reaching sports achievement is supported by many factors. Nutrition is one of the important factors in reaching sports achievement. Physical exercise programs and sports techniques will not be optimal without the support of nutritional intake that suitable the needs of athletes. The nutritional need for athletes include adequate intake of both macronutrients and micronutrients. Adequate nutrient intake provide sufficient energy supply for athletes during training and competition. Similarly, the intake of micronutrients is needed by the body in the process of metabolism. Therefore, it is very important to include nutritional factors as part of an athlete coaching program[1].

The importance of nutrition in supporting sports achievement, so the assessment of nutritional intake is an important activity that must be done. Assessment of the athlete's nutritional intake is an attempt to early detection of possible nutritional problems in athletes[2]. Early detection effort is an important part of a surveillance of nutritional problems in athletes. Surveillance is a continuous series of data collection activities, followed by processing and analyzing data, dissemination of results, and provision of feedback for the development of athletes nutrition program[3]. In Indonesia, nutrition surveillance in athletes is generally not well done. In some sports training center institutions conducted by government there is no athlete nutrition surveillance activity. The absence of nutritional surveillance cause early undetectable nutritional problems.

The lack of early detection nutritional problems in athletes raises the data of athletes with less nutrition and more nutrition. The preliminary study on sports athletes in Central Education Association of Sport Training Student Central Java Province showed 8% of athletes have less nutrition (BMI <18.5 kg / m). The study also revealed that the average energy consumption level of athletes only reached 74% of the recommended energy demand.

Under nutrition problem data and the lack energy intake mentioned above, clarify the need for early detection of nutritional problems in athletes. There are many sports training institutions in Indonesia are unable to assess nutritional intake due to limited fund, time and energy of surveyors [4]. Individual consumption surveys with standard methods, 24-hour recall require trained surveyors. On the other hand the estimated food record method also requires athletes who have nutritional literacy[5]. Therefore, an alternative method of consumption survey is required to overcome these limitations.

Because of assessment need of nutritional intake that is capable for athletes in the Central Education Association of Sport Training Student of Central Java Province, so researcher has developed a method of assessment of nutritional intake based on android called "Nutriatlet". The "Nutriatlet" application adopts and modifies the estimated food record method. The objective of this study was to examine the suitability of nutritional intake assessment method between "Nutriatlet" application with 24-h recalls method.

## II. MATERIALS AND METHODS

### A. Research Design

This research is part of a development study to develop a nutritional application called "Nutriatlet". The development research procedure is done with 9 steps: (1) preliminary study. (2) research planning. (3) early product development. (4) limited field test. (5) revision of limited field test results. (6) more extensive field tests. (7) revision of field test results. (8) feasibility test (9) revision of feasibility test result.

The application reliability assessment of "Nutriatlet" as a method of assessment of nutritional intake of athletes is one of the results of step 3, namely product development.

Software Development

This "Nutriatlet" is a software based on smart phones android. This application has 7 menu, include 1) personal data of athlete, 2) calculation of energy requirement, 3) meal planning, 4) nutritional assessment, 5) nutrition assessment with anthropometry, 6) data report, and 7) export data.

One menu in the Nutriatlet application, namely nutritional assessment is used as an instrument for the assessment of nutritional status by consumption survey. The nutritional assessment menu in this instrument is a modification of the estimated food consumption survey method. Modifications include 3 things: 1) food items 2) the size of food consumed, 3) how to input data, 4) analysis of the results of recording food.

### B. Study Participant

After the development of Nutriatlet application product got validation from expert, then trial to the application of nutriatlet. This trial is intended to measure the application properness from user side. Total of 30 martial arts athletes at Sport Student Training Central of Yogyakarta Province are involved to test and fill in the User Experience Questionnaire. To measure the reliability of Nutriatlet application as an assessment method of nutritional intake of athletes conducted a survey of consumption to 59 sports athletes in Central Education Association of Sport Training Student martial arts Central Java Province

### C. Dietary Assessment

A food consumption survey using a 24-hour recall method done by nutritionists for 7 consecutive days by recording the type and amount of food consumed by athletes over the past 24 hours. With this method, respondents were asked to tell what was eaten and drunk during the past 24 hours (yesterday). Food and beverage intake data are recorded from the time during the interview backwards up to 24 hours in advance. After the interview is completed, 24-hour recall data is converted from household size (URT) to weight size (gram). The process of estimating into the gram size the interviewer uses various tools such as household size samples (plates, cups, spoons and so on) or food models[6].After the list of consumed foods obtained, energy intake analysis was conducted using Indonesian Food Composition Table. Further energy intake data is compared with the total energy needs of individuals, so that the data obtained energy consumption level of each athlete.

Consumption surveys are also done by each athlete using the Nutriatlet application. During the same 7 days, each athlete also recorded their own food and beverage intake. With the Nutriatlet application each athlete notes all food consumed for 24 hours into the "nutritional assessment" menu. Through the menu athletes can fill the food consumed in units of exchangers or weight in grams that will automatically be converted in the form of energy. Furthermore, automatically the results of recording intake of food and beverages are analyzed so that it can be presented total data intake of calories and also the level of energy consumption.

### D. Statistical Analysis

The user feasibility test results data are analyzed descriptively. Consumption survey results were analyzed both univariate and bivariate. Reliability analysis of Nutriatlet application was performed using Bland Altman test.

## III. RESULTS AND DISCUSSION

The nutriatlet application has been tested to 30 martial arts athletes at the Sport Student Training Central of Yogyakarta Province using the User Experiences Questionnaire (UEQ) in Table 1 below. This instrument aims to measure and evaluate the feasibility of the product. This questionnaire has 6 scales with a total of 26 elements. User Experience Questionnaire consists of a pair of opposite attributes that can present a product. The circles between the attributes represent the gradations between opposing attributes.

The measurement scale used in the UEQ includes 6 aspects: attractiveness, efficiency, perspicuity, dependability, stimulation, and novelty[7].

The figure 1 are the results of user feasibility trial: From these results the average value of the impression is 1.751, the value between -0.8 and 0.8 indicates a normal evaluation of the appropriate scale. The impression value > 0.8 is a positive evaluation and the value < -0.8 is a negative evaluation. From the 6 UEQ scores showing > 0.8, this indicates that the Nutriatlet application tends to have a positive impression value approaching to 3) [8].

From Figure 1, the results of the perceptions showed that the attractiveness, dependability, and novelty aspects were categorized as excellent, while the efficiency, and stimulation aspects were good. The scale of perspicuity was categorized above average. This indicates that the results of this application product was feasible to use.

### A. Respondent Characteristic

Table 2 showed the characteristics of athletes involved in the study. Most of the respondents were male (55.9%). Based on the sport, the athletes involved in the research spread the same relative to 7 sports, include wrestling, wushu, karate, taekwondo, boxing, silat, and judo. Total 20.3% of respondents were boxing and silat athletes. According to the body mass index, 30.6% of respondents had a normal body

mass index, but there were 3.4% of respondents with a very thin body mass index.

The distribution of data from 59 athletes involved in the study by sex for weight, height, BMI, and energy needs variables is seen in the boxplots at figure 2

TABLE I. USER EXPERIENCE QUESTIONNAIRES

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
|---|---|---|---|---|---|---|---|---|---|
| difficult | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Fun | 1 |
| Can't be understood | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Can be understood | 2 |
| creative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Monotonous | 3 |
| Easy to learn | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Difficult to lear | 4 |
| useful | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Less useful | 5 |
| boring | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Fun | 6 |
| Not intresting | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Intresting | 7 |
| Can't be predicted | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Can predicted | 8 |
| fast | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Slow | 9 |
| inventive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | conventional | 10 |
| blocked | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Support | 11 |
| good | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Bad | 12 |
| complicated | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Simple | 13 |
| dislike | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Happy | 14 |
| usual | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Lead | 15 |
| uncofortable | ○ | ○ | ○ | ○ | ○ | ○ | ○ | comfortable | 16 |
| safe | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Not safe | 17 |
| motivate | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Not motivate | 18 |
| Fulfill expectation | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Not fulfil expectation | 19 |
| Not efficient | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Efficient | 20 |
| clear | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Confusing | 21 |
| Not practical | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Practical | 22 |
| organized | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Messy | 23 |
| atractive | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Not atractive | 24 |
| User friendly | ○ | ○ | ○ | ○ | ○ | ○ | ○ | User unfriendly | 25 |
| conservative | ○ | ○ | ○ | ○ | ○ | ○ | ○ | Inovative | 26 |

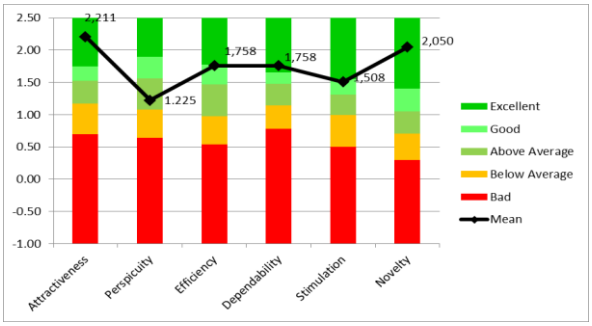



Fig. 1. Result of Perceptional Assessment and Impression Scale Average

Based on the boxplot at figure 2, the distribution of weight and height data according to sex was normally distributed, whereas BMI and energy needs were not normally distributed, due to outliers. The mean (Standard Deviation) weight, height, Body Mass Index, and energy needs of male and female athletes were 62.18 (8.52) and 54.41 (6.85), 167.37 (6.26) and 158.75 (6.58), 21.67 (2.59) and 21.08 (2.24), and 5025.91 (1151) and 3783.85 (1437).

Figures 3 and 4 showed the distribution of energy intake (KiloCalories) and energy consumption level (%) of athletes by sex. The mean (Standard Deviation) energy intake measured by food record in Nutriatlet in male and female athletes was 3464.3 (717.4) and 2694.5 (905,4), while the measured food recall was 3472 , 2 (722,8) and 2694,2 (919,3). In the energy consumption level parameters, the mean (Standard Deviation) measured by food record in Nutriatlet in male and female athletes were 69.49 (5.13) and 72.56 (1.73), while those measured by food recall was 69.61 (5.04) and 72.39 (1.31).

TABLE II. CHARACTERISTIC OF RESPONDENTS BY SEX, SPORT, AND BMI CATEGORY

| Variable | Total | Percentage |
|---|---|---|
| ***Sex*** | | |
| - Male | 33 | 55,9 |
| - Female | 26 | 44,1 |
| ***Sports*** | | |
| - Wrestling | 8 | 13,6 |
| - Wushu | 6 | 10,2 |
| - Karate | 6 | 10,2 |
| - Taekwondo | 9 | 15,3 |
| - Boxing | 12 | 20,3 |
| - Silat | 12 | 20,3 |
| - Judo | 6 | 10,2 |
| ***BMI Category*** | | |
| - Severely Underweight | 2 | 3,4 |
| - Underweight | 3 | 5,1 |
| - Normal | 36 | 61,0 |
| - Overweight | 9 | 15,3 |
| - Obesity | 9 | 15,3 |

## B. *Analysis of Reliability of Nutriatlet Applications*

The Bland Altman graph is a scatter diagram between the measurement averages (x axis) and the difference (y-axis). Most of energy consumption level data were spread between the 2 upper red lines at the value of 1,295 (mean difference + 1.96 x Standard Deviation average difference) and bottom at -1.292 (average difference - 1.96 x Standard Deviation average difference). There is only 1 data outside the red line. Blue line is the average difference of energy consumption level data as measured by food record in Nutriatlet and food recall by nutritionist, is in value 0.002. Bland Altman plot is presented in figure 5.

Based on the result of one sample t test, the mean difference of 2 methods of measuring daily energy intake was 0.002 (-0.17 till 0.17). The value of p was 0.98 which showed that statistically the mean of energy consumption level difference is not different from 0.

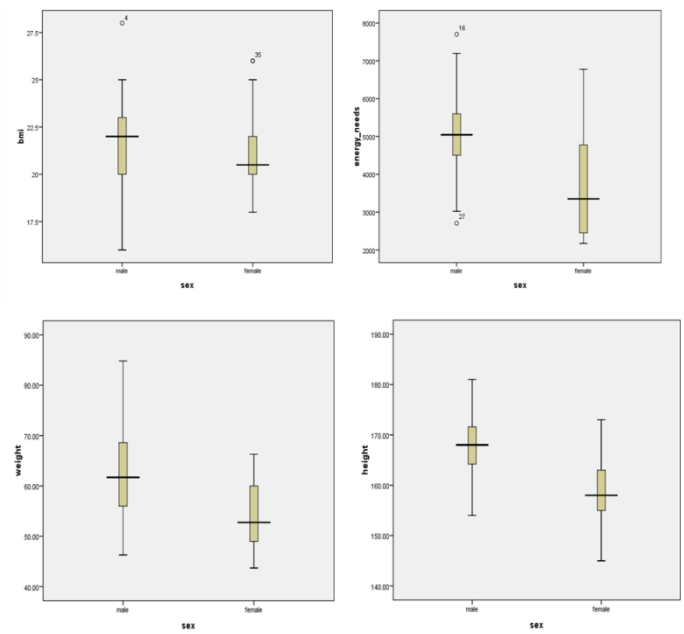



Fig. 2. Data distribution of body weight (kilogram), height (centimeters), BMI (kilogram per square meter), and energy demand (calories) of athlete by sex

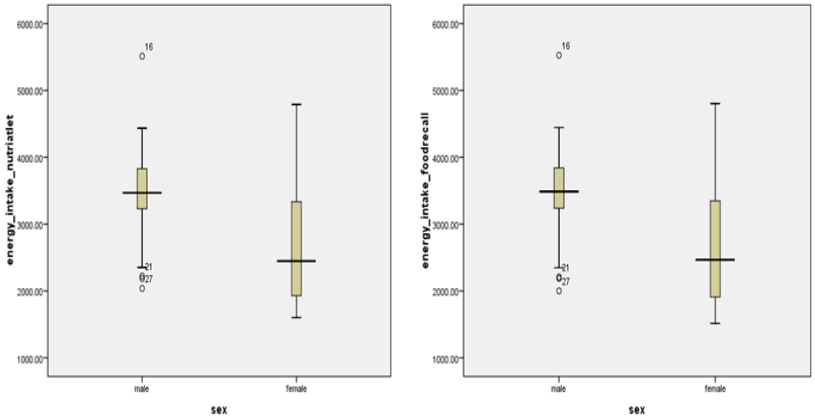



Fig. 3. Distribution of energy intake (KiloCalories) of athletes that measured by food record in Nutriatlet and food recall 24 hours by nutritionist according to sex

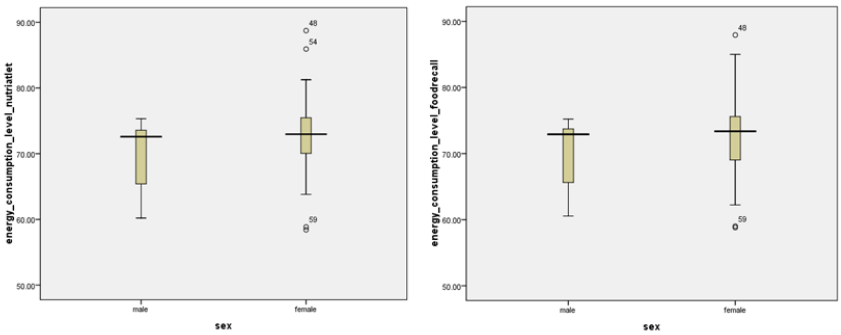
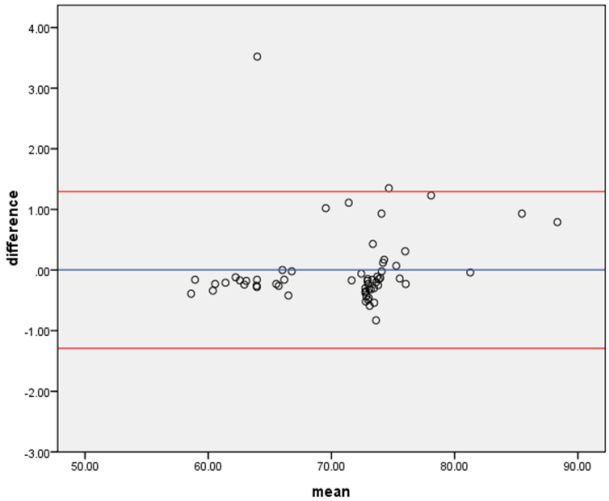



Fig. 4. Distribution of energy consumption level (%) of athlete that measured by food record in Nutriatlet and food recall 24 hours by nutritionist according to




sex

Fig. 5. Bland Altman Plot of reliability energy consumption level measured by food record in Nutriatlet and recall 24 hours by nutritionist

TABLE III. CROSSTABS ENERGY CONSUMPTION LEVELS MEASURED WITH FOOD RECORD IN NUTRIATLET WITH 24-HOUR FOOD RECALL BY NUTRITIONIST

| | | | Energy consumption level dengan foodrecall | | Total | Kappa | p-value |
|---|---|---|---|---|---|---|---|
| | | | ***≥ 70%*** | ***< 70%*** | | | |
| **Energy consumption level dengan Nutriatlet** | ≥ 70% | Total | 38 | 1 | 39 | 0,92 | <0,0001 |
| | | % from total | 64,4 | 1,7 | 66,1 | | |
| | < 70% | total | 1 | 19 | 20 | | |
| | | % from total | 1,7 | 32,2 | 33,9 | | |
| Total | Total | | 39 | 20 | 59 | | |
| | % from total | | 66,1 | 33,9 | 100 | | |

Table 3 showed the suitability of Kappa energy consumption levels that measured by the food record in Nutriatlet with a 24-hour food recall by nutritionists. A total of 96.6% measurements result similar outcome (concordant cells). Meanwhile, as many as 3.4% of the measurements gave different results (discordant cells). The Kappa value between the two measurements was 0.92 (p <0.0001). Thus, it can be concluded that the energy consumption level measured by the application of Nutriatlet has a very good suitability with food recall by nutritionists.

The results of the analysis on the UEQ test (User Analysis Questionnaire) showed the average value of impressions was 1.751. The value > 0.8 indicated that the Nutriatlet application tends to have a positive impression (value approaching 3)[7].It also showed that the application of Nutriatlet was feasible to be used in terms of attractiveness, efficiency, perspicuity, dependability, stimulation, and novelty.

In accordance with Kirkpatrick's study, the used of an application for nutrient consumption surveys should consider the convenience aspects of its use[9]. Compared with conventional consumption survey methods, in Nutriatlet applications there is an analysis of energy intake and nutrients. In the application of Nutriatlet has the availability of database of food and energy content. The foodstuff database also includes household size conversion.(plates, bowls, spoons, glasses) into units of weight (grams). The app is designed to be able to assess food by serving portion sizes into units of weight (grams) to make it easier for users to fill up independently without the help of a nutritionist.

The Nutriatlet application as an instrument survey for nutrient consumption was expected to overcome the problem of limited fund and surveyor on surveys using conventional methods. Research from Freisling and Aziz states that the use of a new alternative method needs to be tested reliability first. If the method is reliable against the standard method that has been used, then the method can be recommended its use[5], [10].

The result of Kappa and Bland Altman conformity test showed that there is a suitability between dietary assessment by applying Nutriatlet and recall 24 hours. The result of one sample t test with p value obtained was 0.98, and Kappa value of 0.92 (p <0.0001) showed that nutriatlet application could be a reliable alternative dietary assessment.

## IV. CONCLUSION

Based on Kappa and Bland Altman conformity test results it can be concluded that there is a suitability of nutritional intake assessment method between Nutriatlet application with 24-h recalls method. The existence of such suitability means that the application of Nutriatlet is a reliable method for assessment of nutritional intake of athletes.

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