Development of SportD-i et application for Thai female football players

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INTRODUCTION

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Introduction

- Previous studies of Mullinix, et al. 2003, Scott, et al. 2003, and Clark, et al. 2003, conducted in the U.S., assessed dietary intakes of female football players in the Under- 21 (U-21) national soccer team and those competing in the National Collegiate Athletic Association (NCAA) Division I. As the result,
  - They found female football players consumed less energy (the U-21 national team average age 19.2 years) averaged 1,778 kcal/d, whereas the NCAA players averaged 2,290 kcal/d with percentage carbohydrate, protein and fat intakes of 47.8 ± 9.8 to 55.0 ± 7.5%, 13.9 ± 4.0 to 15.0 ± 3.1 and 29.0 ± 5.7 to 33.3 ± 9.5 respectively) than energy expenditure (estimated an energy expenditure of about 1,100 (for a 60 kg player) – 2218 kcal/match) [Fogelholm et al. (1995) and Brewer (1994)].
  - Clark et al. (2003) also assessed energy intake pre-and post-season and found significantly lower intakes of energy and all macronutrients post-season.
- Hinton et al., 2004 reported nutrient intakes and dietary behaviors in 142 female collegiate athletes in the U.S.A, including 20 football players. Approximately 70% of the female football players expressed a desire to lose weight and were intentionally restricting energy intake.
- One recent study, Gravina et al., 2012 found dietary intakes of 28 female players from Spanish First and Second division that low energy intake.

Low energy and nutrient intake
Low energy and nutrient intake

FIGURE 1, 2 - Relative energy Deficiency in sport (RED-S) affect athlete health and sport performance

Introduction (cont.)

Overview of digital economy initiatives by region

- **NORTH AMERICA**: 62 initiatives (34%)
- **EUROPE**: 120 initiatives (24%)
- **LATIN AMERICA**: 17 initiatives (23%)
- **ASIA PACIFIC**: 116 initiatives (18%)
- **MIDDLE EAST & AFRICA**: 31 initiatives (19%

- **MOBILE HEALTH**
- **MOBILE FINANCIAL SERVICES**
- **MOBILE COMMERCE AND ADVERTISING**
- **MOBILE EDUCATION**
- **MOBILE AGRICULTURE**

* Mobile commerce and advertising also includes location-based services. Cloud-based services also includes OTT, mobile content, big data and software. Source: Analysys Mason’s Digital Economy Readiness Index (DERI), 2015
Objective

1. To designed and develop sportD-iet smartphone applications (sportD-iet apps) for energy and macronutrients intake self-assessment in Thai female football players.

2. To design sportD-iet app to calculate energy and macronutrient requirement for Thai female football players.

3. To design sportD-iet app to calculate and track energy intake.

4. To design sportD-iet app to calculate and track energy expenditure.

5. To evaluate the association of energy availability with total energy intake and total energy expended.
MATERIALS AND METHODS

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Scope of design and development

SportD-iet app

- Calculate energy and macronutrient needs
- Report total energy intake, % and gram of macronutrient from Add meal immediately
- Calculate energy expended and reports it immediately
- Report energy availability in form picture or color for indicate that they consume not enough.
- Weight, Energy intake, and Energy expended are tracked in form graph (wk, m, and y)
- Set up time intake, Reminder Alerts, and Calendar by Supporting massage

Figures 7. the scope of development of sportD-iet app.
Options of SportD-iet app

- This option will interpret energy and macronutrient requirement as shown in Home. So users have to fill their personal information on sex, age (year), weight (kg), height (cm), and physical activity levels.

- Users can edit personal data and add picture in profile menu.
Options of SportD-iem app (cont.)

Maurine

BMI

Age (y)

Weight (kg)
This option will show:

- Total energy intake
- Total energy expenditure
- Energy requirement
- Total carbohydrate intake and requirement (g and %)
- Total protein intake and requirement (g and %)
- Total fat intake and requirement (g and %)
- Food and activity list
- Energy availability assessment by after user records diet, 2D-cartoon will immediately analyze energy intake: exercise energy expenditure that lacks of energy or not.
This option will interpret energy per meal, gram of carbohydrate, protein, and fat in add meal. So users have to select and record food intake.

Users can edit food data and add food data in Add meal.

The food data from food database of previous study [Ekhatthai ST, 2013] that more than 2,700 items of five food group.
This option will interpret energy expenditure in the homepage. So users have to add activity and duration data of doing that activity and then the Program will immediately show energy expanded.

Users can edit or add activity data in Add activity.

This option will show total energy intake and macronutrients (g and %). It is expressed in color bar graph.

This option will show result of self-tracked weight, energy intake, and energy expended by users can select result in week or month or year. It is expressed in color graph.
Options of SportD-iet app (cont.)

**Calandar**
User can recheck on all diet and activity data of each month. This operation will show energy requirement, energy consumed, and energy expenditure in each day of that month.

**Setting**
For set up time intake, Reminder Alerts, and Calendar alerts by Supporting massage and sound when it’s time to intake and user did not login at least 3 times.
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References


Thank you
Energy availability is defined as the amount of dietary energy remaining to support other body functions after exercise training (dietary energy intake minus exercise energy expenditure). When energy availability is too low to support all body function in addition to exercise, the amount of energy expanded for maintaining cellular function, thermoregulation, growth, and reproduction is reduced. Energy availability is expressed in units of kilocalories or kilojoules per kilogram of fat-free mass.

- The formula of kg FFM: \((25\% - 100\%) \times \text{Body Mass (kg)}\)

- Low energy availability is defined in table 1

# Defining low Energy availability

## Table 1 Defining low energy availability

<table>
<thead>
<tr>
<th>Energy availability (kcal/kg FFM/d)</th>
<th>Zone</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 45</td>
<td>Optimal</td>
<td>Ensure adequate energy for all physiological functions</td>
</tr>
<tr>
<td>30 - 45</td>
<td>Reduced or subclinical</td>
<td>May be tolerated for short periods such as a well-constructed weight-loss program</td>
</tr>
<tr>
<td>&lt; 30</td>
<td>Low</td>
<td>There is a high risk of inadequate energy support for many body functions leading to impairment of health and performance</td>
</tr>
</tbody>
</table>

**Source:**
The formula of Energy availability

**Harris-Benedict (1919) equation** [134]

- **Males** basal metabolic rate = 66.47 + 13.75(Weight in kg) + 5(Height in cm) – 6.76(age in years)
- **Females** basal metabolic rate = 655.1 + 9.56(Weight in kg) + 1.85(Height in cm) – 4.68 (age in years)

**PA** level

- **1.0-1.3** Sedentary (eg, household tasks, walking to bus).
- **1.4-1.5** Light activity, Intensive exercise for at least 20 minutes 1 to 3 times per week.
- **1.6-1.8** Moderate activity, Intensive exercise for at least 30 to 60 minutes 3 to 4 times per week (female).
- **1.7** Moderate active, Intensive exercise for at least 30 to 60 minutes 3 to 4 times per week (male).
- **1.9-2.4** Very active, Intensive exercise for 60 minutes or greater 5 to 7 days per week
- **> 2.4** Extremely Active, athlete with an almost unstoppable training schedule with multiple training sessions throughout the day

**Total daily energy requirement** (kcal/day) = Basal metabolism rate (BMR) \( \times \) PA level

**Energy expended** (kcal/session) = METs \( \times \) 0.0175 \( \times \) duration (min) \( \times \) kg body weight

**Energy Intake** (kcal/day) = Energy of food per day

**Energy availability** (kcal/kg FFM) = \[
\frac{\text{energy intake} - \text{exercise energy expended}}{\text{kg FFM (fat Free Mass)}}
\]

**Figure 2.** Estimate total daily energy requirement, energy expanded, and energy availability for athletes. Adapted from reference 14, 99, 212, 214.

*PA= physical activity.*
Materials and Methods (cont.)

The amount of CHO, Protein for athletes

Table 3 the recommenced of carbohydrate intake goals for athletes

<table>
<thead>
<tr>
<th>Physical Activity Levels</th>
<th>g/kg BM/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal physical activity</td>
<td>2-3g CHO/ kg BM</td>
</tr>
<tr>
<td>Light physical activity (3-5 hr/week)</td>
<td>4-5g CHO/ kg BM</td>
</tr>
<tr>
<td>Medium physical activity (10hr/week)</td>
<td>6-7g CHO /kg BM</td>
</tr>
<tr>
<td>Professional/elite athletes (20+ hr/week)</td>
<td>10-12g CHO/kg BM</td>
</tr>
</tbody>
</table>

*CHO = carbohydrate, BM = body mass, Adapted from: reference 32, 100, 101

Table 4 the recommendation of daily protein requirements for physical activity

<table>
<thead>
<tr>
<th>Physical activity level</th>
<th>g/kg BW/day</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General fitness</td>
<td>0.8-1.0 g/kg BW</td>
<td>Focus on protein quality.</td>
</tr>
<tr>
<td>Older individuals</td>
<td>1.0-1.2 g/kg BW</td>
<td>Amino-acid content.</td>
</tr>
<tr>
<td>Moderate amount of intense training</td>
<td>1.0-1.5 g/kg BW</td>
<td>Whole foods.</td>
</tr>
<tr>
<td>High volume of intense training</td>
<td>1.5-2.0 g/kg BW</td>
<td>Safe, convenient supplements where needed</td>
</tr>
</tbody>
</table>

* Adapted from: reference 184, 100, 32, and 101
The amount of Fat for athletes

- Fat is 20-25% of total energy requirement according to the American Dietetic Association (ADA), the Dietitians of Canada and the American College of Sports Medicine (ASDM), the international Olympic Committee, and the international Society for Sports Nutrition.

The timing intake: before-, during-, and recovery-exercise

- The amount and timing intake uses to the American Dietetic Association (ADA), the Dietitians of Canada and the American College of Sports Medicine (ASDM), the international Olympic Committee, and the international Society for Sports Nutrition.
The amount and timing intake of **before- exercise**

**Table 5** the amount and timing of pre-exercise meals

<table>
<thead>
<tr>
<th>Timing of meals/snacks before exercise</th>
<th>Amount</th>
<th>Food guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4 hours before event (Regular meals)</td>
<td>3-5 grams of carbohydrate/kg</td>
<td>150-300 grams (≥ 600 kcals)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3 hours before event (Smaller meals)</td>
<td>2 grams of carbohydrate/kg</td>
<td>100-200 grams (400-500 kcals)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2 hours before event (Snack)</td>
<td>1 gram of carbohydrate/kg</td>
<td>&lt; 100 grams (200 – 400 kcals)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1 hour (small snack: liquid snack)</td>
<td>0.5 gram of carbohydrate /kg</td>
<td>100-200 kcals</td>
</tr>
<tr>
<td>Less than 30 minutes (Mini Snack: liquid snack)</td>
<td>6-8 % carbohydrate/electrolyte solution</td>
<td>50-100 kcals</td>
</tr>
</tbody>
</table>

**Adapted from:** reference 177, 178
The amount and timing intake of during-exercise

Table 6 the amount and timing of during-exercise meals

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Duration</th>
<th>Carbohydrate intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>During brief exercise</td>
<td>&lt; 45 min</td>
<td>Not needed</td>
</tr>
<tr>
<td>During sustained high-intensity exercise</td>
<td>45-75 min</td>
<td>Small amounts including mouth rinse</td>
</tr>
<tr>
<td>During endurance exercise including “stop and start” sports</td>
<td>1-2.5 h</td>
<td>30-60g/hour</td>
</tr>
<tr>
<td>During ultra-endurance exercise</td>
<td>&gt;2.5-3 h</td>
<td>Up to 90 g/h</td>
</tr>
</tbody>
</table>

Adapted from: reference 177, 178
The amount and timing intake of recovery-exercise

- Carbohydrate should consume 1.0 to 1.5 g/kg body weight (5 to 7 g/kg/day) during the first 30 min and again every 2 h for 4 to 6 h will be adequate to replace glycogen stores.
- Protein consumed immediately after training or competition will provide amino acids for the building and repair of muscle tissue is 0.3 g/kg BM or approximate 20 to 25 g of high quality protein and consumed it within 3hr and include before bed with carbohydrate.
- Fat intake should range from 20% to 25% of total energy intake because consuming ≥ 20% of energy from fat does not benefit performance
- Fluid with single carbohydrate, water, and electrolytes such as sodium, the athlete should drink at least 100-150% of body mass loss of fluid for every kilogram or pound (0.5 kg) of body weight lost during training and competition within 6 hour

# % Body fat for the athletes

## Table 2 % Body fat levels for gender

<table>
<thead>
<tr>
<th>Female body fat levels</th>
<th>Male body fat levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% Body fat</strong></td>
<td><strong>%Body fat</strong></td>
</tr>
<tr>
<td>Bodybuilding competition levels/ High level anorexia</td>
<td>Bodybuilding competition levels/ High level anorexia</td>
</tr>
<tr>
<td>8 – 12% (unsustainable)</td>
<td>3 – 4% (unsustainable)</td>
</tr>
<tr>
<td>Figure competitor/Extremely thin model</td>
<td>Very lean/ Very lean Model</td>
</tr>
<tr>
<td>13-15% (General sustainable)</td>
<td>6 – 9% (General sustainable)</td>
</tr>
<tr>
<td>Athletic/Model</td>
<td>Model/Athletic</td>
</tr>
<tr>
<td>16-19% (General sustainable)</td>
<td>10-15% (General sustainable)</td>
</tr>
<tr>
<td>Athletic</td>
<td>Athletic</td>
</tr>
<tr>
<td>20-25% (sustainable)</td>
<td>15-20% (sustainable)</td>
</tr>
</tbody>
</table>

## % Body fat for the athletes

### Table 3 % Body fat for female in age groups

<table>
<thead>
<tr>
<th>Age groups</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Increased Health Risk)</td>
<td>&lt;14</td>
<td>&lt;14</td>
<td>&lt;14</td>
<td>&lt;14</td>
<td>&lt;14</td>
</tr>
<tr>
<td>Good/Normal (Healthy)</td>
<td>16.6</td>
<td>17.5-20.8</td>
<td>19.9-23.8</td>
<td>22.6-27.6</td>
<td></td>
</tr>
<tr>
<td>Fair/Average (Healthy)</td>
<td>19.5</td>
<td>20.9-24.6</td>
<td>23.9-27.6</td>
<td>27.1-31.3</td>
<td></td>
</tr>
<tr>
<td>Poor (Increased Health Risk)</td>
<td>22.8-27.1</td>
<td>24.7-29.1</td>
<td>27.7-31.3</td>
<td>30.5-34.5</td>
<td></td>
</tr>
<tr>
<td>High (Increased Health Risk)</td>
<td>&gt;27.2</td>
<td>&gt;29.2</td>
<td>&gt;31.3</td>
<td>&gt;34.6</td>
<td>&gt;35.5</td>
</tr>
</tbody>
</table>

Source:
#### % Body Fat for the Athletic Population

Table 4 % Body Fat for Type of Sport

<table>
<thead>
<tr>
<th>Sport</th>
<th>Male</th>
<th>Female</th>
<th>Sport</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>12-15%</td>
<td>12-18%</td>
<td>Rowing</td>
<td>6-14%</td>
<td>12-18%</td>
</tr>
<tr>
<td>Basketball</td>
<td>6-12%</td>
<td>20-27%</td>
<td>Shot Putters</td>
<td>16-20%</td>
<td>20-28%</td>
</tr>
<tr>
<td>Bodybuilding</td>
<td>5-8%</td>
<td>10-15%</td>
<td>Skiing (X country)</td>
<td>7-12%</td>
<td>16-22%</td>
</tr>
<tr>
<td>Cycling</td>
<td>5-15%</td>
<td>15-20%</td>
<td>Sprinters</td>
<td>8-10%</td>
<td>12-20%</td>
</tr>
<tr>
<td>Football (Backs)</td>
<td>9-12%</td>
<td>No data</td>
<td>Soccer</td>
<td>10-18%</td>
<td>13-18%</td>
</tr>
<tr>
<td>Football (Linemen)</td>
<td>15-19%</td>
<td>No data</td>
<td>Swimming</td>
<td>9-12%</td>
<td>14-24%</td>
</tr>
<tr>
<td>Gymnastics</td>
<td></td>
<td></td>
<td></td>
<td>12-16%</td>
<td>16-24%</td>
</tr>
<tr>
<td>High/Long Jumpers</td>
<td></td>
<td></td>
<td></td>
<td>5-12%</td>
<td>10-15%</td>
</tr>
<tr>
<td>Ice/Field Hockey</td>
<td></td>
<td></td>
<td></td>
<td>11-14%</td>
<td>16-25%</td>
</tr>
<tr>
<td>Marathon Running</td>
<td>5-11%</td>
<td>10-15%</td>
<td>Weightlifters</td>
<td>9-16%</td>
<td>No data</td>
</tr>
</tbody>
</table>

Thus, this study assumed % body fat that 20% from table 2-4