Developing a New Tool for Early Detection of the Nutritional and Health Risk Factors of Urban Workers’ Productivity

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Abstract
Nutrition and health play vital roles in work productivity. This study aimed to develop a risk self-assessment tool called Deteksi Dini Faktor Risiko Gizi dan Kesehatan (DDR-GizKes) for early detection of the nutritional and health risk factors of urban workers’ productivity. This study was conducted in two stages: 1) the development of the tool to determine the nutritional and health risk factors affected productivity based on literature reviews and scoring systems; and 2) the testing of validity and reliability. Finally, the tool contained 63 items, including 28 items on nutritional risk factors and 35 items on health risk factors. The validity of the tool was assessed using the content validity index (CVI): item-level CVI (I-CVI) and scale-level CVI (S-CVI) and face validity index (FVI), and its reliability was using Cronbach’s alpha coefficient. Preliminary versions of this tool showed a high content validity (I-CVI = 1.00; S-CVI based on the average method = 1). The face validity index among urban workers was at least 0.90, and the overall Cronbach’s alpha coefficient was 0.70. The tool developed is acceptable, but revisions are still needed, and sample sizes must be increased.

Keywords: health, nutrition, productivity, urban workers

Introduction
Increasing work productivity has become the most important goal for sustainable economic growth. Accordingly, there is a growing interest in what determines work productivity and how to increase it.1 A previous study found that physical inactivity and unhealthy eating behaviors are responsible for the loss of productivity from two sources: absenteeism (due to illness or disability) and decreased productivity while working.2 Furthermore, an unhealthy diet and a sedentary lifestyle are risk factors for the emergence of noncommunicable diseases (NCDs). These diseases are a crucial factor that may reduce worker’s productivity.3 In addition, many workers experience both overnutrition and undernutrition, impacting the workers’ health and risk of work accidents and cardiovascular disease.4 Diet without considering nutritional adequacy can cause obesity, including central obesity, which is also a risk factor for the emergence of NCDs such as cardiovascular disease, type 2 diabetes mellitus, musculoskeletal disorders (especially osteoarthritis), and several types of cancer.5 The coronavirus disease (COVID-19) pandemic has exacerbated NCDs. Furthermore, COVID-19 patients with NCDs are much more likely to develop a more severe illness than average patients and to die than patients without NCDs.6

The NCDs also negatively impact patients, caregivers, and the community in terms of the quality of life and economy.7 Patients spend heaps of money on nursing and treatment. A systematic review has shown that the average total costs per year for a patient/household in low- and middle-income countries concerning chronic obstructive pulmonary disease, cardiovascular disease, cancer, and diabetes mellitus were USD 7,386.71, USD 6,055.99, USD 3,303.81, and USD 1,017.05, respectively.8

Currently, the most significant challenges that may increase the incidence of NCDs are urbanization, diet, work, and lifestyle.9 Urban environments in low- and middle-income countries face a triple health burden of communicable diseases, NCDs, mental health problems, and injuries, which could be worse in the future and accelerate the increase in the incidence of overweight and obesity over the past few decades.10 This increase has
been triggered by rising urban incomes, and changes in consumption patterns wherein urban consumers consume more sugar, fat, oil, and processed foods. In addition, urban environments are also associated with a sedentary lifestyle and fewer opportunities to practice physical exercise.

The NCDs kill 41 million people yearly, equivalent to 74% of all deaths globally. Each year, 17 million people die of NCDs before the age of 70 years; 86% of these premature deaths occur in low- and middle-income countries. The NCDs may reduce workers’ productivity, because sickness or work absenteeism owing to illness hinders the achievement of workplace organizational goals. The workplace then experiences losses, impacting national economic conditions. Conversely, workers’ lifestyles may also trigger the emergence of NCDs. A previous study has reported a few NCD risk factors among working women, including low physical activity, sedentary lifestyle, and poor dietary habits, such as skipping breakfast, frequent snacking, junk food consumption, and low intake of vegetables and fruits.

Early detection of nutritional and health status conditions can identify the onset of diseases that impact workers’ productivity. Furthermore, impacts and problems related to nutritional status and fatigue experienced by workers affect productivity in the short, medium, and long terms. Existing studies in the literature are limited to cross-sectional studies of the relationship between nutritional and health factors of urban workers’ productivity. The tool was based on the World Health Organization STEPwise approach to surveillance (STEPS). In this study, the following nutritional factors were added to the tool: dietary diversity, food adequacy, variations in protein consumption, sugar consumption, and breakfast habits, in addition to a health factor—sleep duration at night. These factors, related to NCDs and workers’ productivity, are excluded in the STEPS. This study also developed a scoring system to determine nutritional and health risk scores, which aimed to develop a risk self-assessment tool, named DDR-GizKes, for early detection of the nutritional and health risk factors of urban workers’ productivity. Detection, screening, and treatment of NCDs are key components of the response to NCDs. Therefore, this study is urgently needed and can be a preliminary study for future studies.

Method

This study used a cross-sectional survey design. The population was civil servants in the Yogyakarta City, particularly staff of service and district officials. Permanent workers aged ≥20 years who were not on a diet for certain diseases and not pregnant (for female workers) were included. A total of 220 staff participated in the reliability test of the tool. The sample size was calculated based on sample size tables for Cronbach’s alpha test. The alpha coefficient was 0.05; power, 90.0% (nb); the number of items, 60; Cronbach’s alpha coefficient in the null hypothesis (CA0), 0.50; and Cronbach’s alpha coefficient in the alternative hypothesis (CA1), 0.65. Based on the table, the minimum sample size required was 170. A total of 220 participants were included and filled in the data completely. The face validity test was conducted before the reliability test. Of 20 educators at STIKes Panti Rapih Yogyakarta with different locations of residence (urban or rural), levels of education, and types of work were selected via purposive sampling for initial testing of the face validity to understand the items.

The sampling technique used was multistage random sampling consisting of random clusters and simple random sampling. Random cluster sampling was used to select service and district office clusters. Eight service offices (Tourism Office; Education, Youth, and Sports Office; Social, Workforce, and Transmigration Office; Library and Archives Office; Population and Civil Registry Office; Public Works, Housing, and Residential Area Office; Land Registry and Spatial Planning Office; and Fire Fighting and Rescue Office) and two district offices (Pakualaman and Gondomanan District Offices) in Yogyakarta City were selected for the sampling. Moreover, random sampling was considered based on a list of names of staff from each office. However, several offices could not furnish a list of staff; therefore, only those who met the inclusion criteria were included.

There were two main variables in this study: nutritional and health factors, which were measured by determining the sub-variables, indicators, and items. This study developed a tool for the early detection of the nutritional and health risk factors of urban workers’ productivity. The tool was developed based on previous literature examining the relationship between nutritional and health factors and NCDs, nutritional and health factors affecting productivity, aspects of nutrition and health in urban areas, and STEPS. The tool contained items on nutritional and health risk factors. Each item was tested for its content validity, face validity, and reliability.

The sociodemographic characteristics of the participants evaluated in the reliability test included age (20–29, 30–39, 40–49, and ≥50 years); sex; education (did not complete elementary school, completed elementary school, completed junior high school, completed senior
The physical activity
The content validity was evaluated in
The formula used for cal
22,29
Developing a New Tool for Early Detection of the Nutritional and Health Risk Factors of Urban Workers' Productivity
Two forms of the CVI
21-23
First, a validity form
3 expert reviewers rated each
This study adopted both approaches. Two expert
reviewers were met directly, and one was sent a review
format. Fourth, the domain and item in question were
reviewed. The expert reviewers were asked to critique the
domain reviewed and its items before assigning a score to
each item and providing a written comment to increase
the item’s relevance to the target domain. Fifth, each item
was assigned a score, and sixth, the content validity index
(CVI) was calculated. The face validity reflected the clari-
ty and understandability of question items. Herein, the
workers were asked to score from 1 (item not clear and
not understandable) to 4 (item very clear and understand-
able) based on the clarity and comprehensibility of the
items in DDR-GizKes.28 Cronbach’s alpha coefficient was
used to assess reliability.
A univariate analysis was performed to evaluate the
participant characteristics, which were described in fre-
quencies and percentages. The content validity was assess-
ed using the CVI which is the recommended and most
commonly-used parameter for quantitatively calculating
content validity.26,28 Three expert reviewers rated each
item on a Likert scale ranging from 1 (e.g., irrelevant or
non-representative) to 4 (e.g., highly relevant or highly
representative). Before the CVI was calculated, the rele-
ance rating was re-encoded as 1 (relevance scale 3 or 4)
or 0 (relevance scale 1 or 2). Items with a rating of 1 and
2 were considered invalid, while items with a rating of 3
and 4 were considered valid.22,29 Two forms of the CVI
were utilized: item-level CVI (I-CVI) and scale-level CVI
(S-CVI). The S-CVI was calculated using the universal
agreement (UA) among experts (S-CVI-UA) and the aver-
age CVI (S-CVI/Ave). An I-CVI of 0.78 and S-CVI/Ave
of ≥0.90 indicated good content validity.28
The face validity index (FVI) assessed the complete-
ness and clarity of each item. Before the FVI was calcu-
lated, the comprehension rating was re-encoded as 1 (com-
prehension scale 3 or 4) or 0 (comprehension scale 1 or
2). For the FVI, ratings of 3 and 4 were recategorized as
1 (clear and understandable) and ratings of 1 and 2 as 0
(unclear and understandable).28 The formula used for cal-
culating the FVI was FVI = (summation of FVI
score)/(max score*number of raters).29
Internal consistency was measured to determine the
reliability of the two variables of DDR-GizKes using
Cronbach’s alpha coefficient for the subscale and overall
scale. Data from the 220 participants were entered into

high school, completed a diploma program, completed
bachelor’s program, completed master’s program, and
completed doctoral program); monthly income (IDR
<2,000,000; 2,000,000–3,999,999; 4,000,000–
5,999,999; 6,000,000–7,999,999; and ≥8,000,000); and
marital status (married and single/divorced). A structured
questionnaire was used to collect data on these sociode-
mographic characteristics.

The study was conducted in two stages. The first stage
was developing the risk self-assessment tool and risk sco-
res. The tool was developed based on existing studies, in-
cluding those 1) identifying research variables; 2) dividing
these variables into sub-variables/dimensions; 3) identi-
fying indicators/aspect of each sub-variable; 4) formula-
ting the descriptor of each indicator; 5) formulating each
descriptor into question items; and 6) equipping the in-
strument with charging instructions and prefaces.21-25
The items were developed based on existing indicators.
Items on nutritional factors were developed based on
previous findings, and items on health factors based on
question items previously developed, such as physical ac-
tivity and alcohol consumption.19,24 The physical activity
and alcohol consumption items were translated into the
Indonesian language by the Language Unit at the Faculty
of Education, Universitas Negeri Yogyakarta. The risk
score was developed using the category of each indicator.
The DDR-GizKes consisted of items on nutritional factors (dietary diversity, food adequacy, variety of prote-
in sources, amount of sugar consumption, frequency of
high-sugar food or drink consumption, amount of salt
consumption, frequency of high-salt food or drink con-
sumption, frequency of breakfast, type of food for break-
fast, amount of water consumption, abdominal circumfe-
rence, waist circumference, hip circumference, and body
mass index) and health factors (physical activity, smoking
behavior, alcohol consumption, and sleep duration). The
scoring system used was a three-level category (0, 5, and
10).25 For the nutritional risk factors, a score of 0 with
each indicator indicated a risk of undernutrition; 5, nor-
mal nutrition; and 10, a risk of overnutrition associated
with NCDs. For the health risk factors, a score of 0 with
each indicator indicated a low health status; 5, good he-
alth status; and 10, high health status related to NCDs.
The second stage was testing the validity and reliability
of DDR-GizKes. Both content and face validities were as-
sessed. Content validity generally refers to the validity es-
timated by testing the feasibility or relevancy of test con-
tensts through rational analysis by a competent panel or
expert judgment.26 The content validity was evaluated in
six steps, as previously described.22 First, a validity form
was prepared to ensure that expert panel reviewers clearly
understood the task assigned by the authors. Thereafter,
each indicator was assigned to help experts assess the
question items based on the indicator definition. Second,
expert reviewers were selected. The expert panel must ha-
ve included at least three reviewers, had experience of at
least 10 years, and been experienced in conducting sur-
veys and questionnaires and/or utilizing substantive ma-
terials.23,27
Third, the content validity was assigned by the expert
reviewers. Typically, the content validity could be evalu-
ated face-to-face or non-face-to-face with a panel of ex-
erts.22 This study adopted both approaches. Two expert
reviewers were met directly, and one was sent a review
format. Fourth, the domain and item in question were re-
viewed. The expert reviewers were asked to critique the
domain reviewed and its items before assigning a score to
each item and providing a written comment to increase
the item’s relevance to the target domain. Fifth, each item
was assigned a score, and sixth, the content validity index
(CVI) was calculated. The face validity reflected the clari-
ty and understandability of question items. Herein, the
workers were asked to score from 1 (item not clear and
not understandable) to 4 (item very clear and understand-
able) based on the clarity and comprehensibility of the
items in DDR-GizKes.28 Cronbach’s alpha coefficient was
used to assess reliability.
A univariate analysis was performed to evaluate the
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quencies and percentages. The content validity was assess-
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commonly-used parameter for quantitatively calculating
content validity.26,28 Three expert reviewers rated each
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representative). Before the CVI was calculated, the rele-
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or 0 (relevance scale 1 or 2). Items with a rating of 1 and
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of ≥0.90 indicated good content validity.28
The face validity index (FVI) assessed the complete-
ness and clarity of each item. Before the FVI was calcu-
lated, the comprehension rating was re-encoded as 1 (com-
prehension scale 3 or 4) or 0 (comprehension scale 1 or
2). For the FVI, ratings of 3 and 4 were recategorized as
1 (clear and understandable) and ratings of 1 and 2 as 0
(unclear and understandable).28 The formula used for cal-
culating the FVI was FVI = (summation of FVI
score)/(max score*number of raters).29
Internal consistency was measured to determine the
reliability of the two variables of DDR-GizKes using
Cronbach’s alpha coefficient for the subscale and overall
scale. Data from the 220 participants were entered into

43
the statistical analysis data software. Cronbach’s alpha coefficients of ≤0.60 indicated low reliability and were considered unacceptable; 0.60–0.80 indicated moderate reliability and was considered acceptable; 0.80–1.00 indicated

Table 1. Sub-Variables, Risk Factors, Criteria, and Scoring of the Tool Items

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sub-variable</th>
<th>Indicator/risk Factor</th>
<th>Scoring Criterion</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional factor</td>
<td>Dietary diversity&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Poor dietary diversity</td>
<td>&lt;4 types of food group/day</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Food adequacy&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Inadequate carbohydrate intake</td>
<td>&lt;3 servings/day</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate animal protein intake</td>
<td>≥4 servings/day</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate vegetable protein intake</td>
<td>≥4 servings/day</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate fruit intake</td>
<td>≥3 servings/day</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate vegetable intake</td>
<td>≥3 servings/day</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Variety of protein source&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Invariable consumption of protein-source foods</td>
<td>≥3 different sources/day</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Amount of sugar consumption&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Excess sugar consumption</td>
<td>≥4 tablespoons/50 g</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Frequency of high-sugar food or drink consumption</td>
<td>High frequency of consumption of high-sugar</td>
<td>Always/often</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Amount of salt consumption&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Excess salt consumption</td>
<td>≥1 teaspoon (2,000 mg)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Frequency of high-salt food or drink consumption</td>
<td>High frequency of consumption of high-salt</td>
<td>Always/often</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Frequency of breakfast</td>
<td>Low frequency of breakfast</td>
<td>Always/often</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Type of food for breakfast&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Poor dietary diversity for breakfast</td>
<td>≥3 types of food group/day</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Amount of water consumption&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Less water consumption</td>
<td>≥8 glasses</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Abdominal circumference&lt;sup&gt;32&lt;/sup&gt;</td>
<td>Abdominal circumference</td>
<td>Male &gt;90 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤90 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Female &gt;80 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤80 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male &gt;94 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤94 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Female &gt;80 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤80 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Male &gt;102 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤102 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Female &gt;88 cm</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤88 cm</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Body mass index</td>
<td>&lt;18.5: underweight</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18.5–22.9: normal</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>23.0–24.9: overweight</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≥25: obesity</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Health factor</td>
<td>Insufficient physical activity at work</td>
<td>Low physical activity</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Physical activity for transport&lt;sup&gt;19&lt;/sup&gt;</td>
<td>Insufficient physical activity for transport</td>
<td>Low physical activity</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Physical activity during leisure time&lt;sup&gt;19&lt;/sup&gt;</td>
<td>Insufficient physical activity during leisure time</td>
<td>Low physical activity</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Smoking behavior</td>
<td>Duration and quantity of smoking</td>
<td>Light smoker (0–199 cigarettes)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Alcohol consumption&lt;sup&gt;24&lt;/sup&gt;</td>
<td>Alcohol consumption</td>
<td>Moderate and heavy smokers (&gt;200 cigarettes)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Sleep duration&lt;sup&gt;34&lt;/sup&gt;</td>
<td>Short duration of sleep at night</td>
<td>&lt;7 hours</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7–8 hours</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≥8 hours</td>
<td>10</td>
</tr>
</tbody>
</table>
Results

Stage 1: Development of the Risk Self-Assessment Tool and Risk Scores

The tool was developed based on previous literature.10,11,17-19 Ultimately, it contained 14 sub-variables and 18 indicators of nutritional risk factors and six sub-variables and six indicators of health risk factors. From these indicators, 63 items were obtained, including 28 items on nutritional risk factors and 35 items on health risk factors to develop early versions of DDR-GizKes (Table 1).

For the nutritional factors, the maximum score was 145, which was the combined score of each indicator. The normal value was calculated using the median value from the combined scores of all indicators. The categories of the nutritional risk factors were as follows: 0–72, risk of undernutrition; 73–90, normal nutrition; and 91–145, risk of overnutrition.

For the health factors, the maximum score was 40, which was the combined score of four indicators. Of the three indicators of physical activity, only one was considered according to the condition of the participants. The normal value was calculated using the median value from the combined scores of all indicators. The categories of the health risk factors were as follows: 0–19, low health status; 20–21, good health status; and 22–40, high health status related to NCDs.

Stage 2: Validity and Reliability Test

The content and face validities were assessed. The results of the CVI and FVI analysis are presented in Table 2. As shown in Table 2, both the I-CVI and S-CVI were 1. This finding indicated that this tool had excellent content validity because the I-CVI meets the criteria of a minimum I-CVI of 1 for three experts. While, the S-CVI/Ave and S-CVI/UA met a satisfaction level of more than 0.90. The inter-worker FVI was 0.9–1, and the average S-FVI was 0.99. The results indicated good FVI.

Finally, at the end of the content and face validity tests, this tool was prepared with 63 items for the next steps. For the reliability test, the abdominal circumference, waist circumference, hip circumference, and body mass index were considered.

Table 2a. Content Validity and Face Validity of the Tool

<table>
<thead>
<tr>
<th>Component</th>
<th>Item</th>
<th>Input</th>
<th>I-CVI among Experts (n = 3)</th>
<th>UA</th>
<th>I-FVI among Employees (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional factor</td>
<td>Dietary diversity</td>
<td>G1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G9</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Food adequacy</td>
<td>G2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G4</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G6</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G8</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G10</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Variety of protein source</td>
<td>G11</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G12</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
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<td>G15</td>
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<td>Amount of sugar consumption</td>
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<td>1</td>
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<td>G17</td>
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<td>Frequency of high-sugar food or drink consumption</td>
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<td>Amount of salt consumption</td>
<td>G19</td>
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<td>Frequency of high-salt food or drink consumption</td>
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<td>Frequency of breakfast</td>
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<td>Add &quot;salty snacks&quot;</td>
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<td>Type of food for breakfast</td>
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<td>Amount of water consumption</td>
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<td>Abdominal circumference</td>
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<tr>
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<td>Waist circumference</td>
<td>G25</td>
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<td>Hip circumference</td>
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<td>Body mass index</td>
<td>G27</td>
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<tr>
<td></td>
<td>G28</td>
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</table>

Notes: I-CVI = Item-level Content Validity Index, UA = Universal Agreement, I-FVI = Item-level Face Validity Index, S-CVI = Scale-level Content Validity Index, Ave = Average, S-CVI/Ave = Scale-level Content Validity Index based on the Average Method, S-CVI/UA = Scale-level Content Validity Index based on the Universal Agreement Method; S-FVI = Scale-level Face Validity Index.
mass index were excluded as they were the results of direct measurements. Therefore, only 59 items were included in the reliability test.

**Internal Consistency Reliability**

A total of 220 workers participated in this study. Their sociodemographic characteristics are shown in Table 3. Table 3 shows that the number of female and male in this study is almost equal (50.5% and 49.5%, respectively). Most respondents are aged 40–49 years (30.5%), have completed a bachelor’s program (40.9%), earn a monthly income of IDR 2,000,000–3,999,999 (54.5%), and were married (68.6%).

As shown in Table 4, the overall Cronbach’s alpha coefficient was 0.70, whereas the specific alpha coefficients for the nutritional and health factors were 0.649 and 0.707, respectively. The overall and variable-specific Cronbach’s alpha coefficients exceeded 0.6, which was considered acceptable.

**Discussion**

This study examined and assessed the content validity of DDR-GizKes in terms of the nutritional and health factors of the productivity of urban workers. DDR-GizKes is a risk self-assessment tool that can help detect early nutritional and health risk factors associated with NCDs. Work productivity is influenced by factors with a significant and determining role: nutritional adequacy and health degree.

In this study, dietary diversity, food adequacy, variations in protein consumption, sugar consumption, and breakfast habits, which were excluded in the previous li-

### Table 2b. Content Validity and Face Validity of the Tool

<table>
<thead>
<tr>
<th>Component</th>
<th>Item</th>
<th>Input</th>
<th>I-CVI among Experts (n = 3)</th>
<th>UA</th>
<th>I-FVI among Employees (n = 20)</th>
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<tr>
<td>Health factors</td>
<td>Physical activity at work</td>
<td>K1</td>
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<tr>
<td></td>
<td></td>
<td>K3</td>
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</tr>
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<td></td>
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<td>K4</td>
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<td>K5</td>
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<td>Physical activity for transport</td>
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<td>K9</td>
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<td>Physical activity during leisure time</td>
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<td>K15</td>
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<tr>
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<td>Smoking behavior</td>
<td>K16</td>
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<td>K24</td>
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<tr>
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<td>Alcohol consumption</td>
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<td>K26</td>
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<td>K31</td>
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<td>K32</td>
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<td></td>
<td></td>
<td>K33</td>
<td>Add “physically injured”</td>
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<td>Sleep duration</td>
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<td></td>
<td></td>
<td>K35</td>
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</table>

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Therefore, this study...n necessary as the initial...eral. Based on the test’s intended go...mean of this parameter remains necessary as the initial...medianado. Herein, the low alpha coefficient could...of questions; hence, some items needed to be either revised or deleted.33

In this study, the questions on nutritional factors (24 items) were fewer than those on health factors (35 items). However, increasing the number of questions may increase the total number of questions, which might cause respondents to feel bored in answering the questionnaire. Thus, developed questions may be revised, or the minimum sample size may be increased. The minimum sample size was met in this study; however, a larger sample size is recommended. The overall score was 0.70, which indicated an acceptable internal consistency.

The strength of this study was that it succeeded in developing a tool and scoring system for early detection of the nutritional and health risk factors of productivity of urban workers. This study added nutritional and health factors for NCDs that have not been used in previous studies. Therefore, it can be a preliminary study for subsequent similar studies. The weakness of this study was the operationalization and conceptualization, which could be developed good questionnaires and question items.23,27 Herein, there were difficulties in recruiting expert reviewers who were experts in the field of occupational nutrition with at least ten years of experience and developing questionnaires. Six experts who were contacted were not willing to participate as experts.

The FVI indicated the ease of comprehension of question items. In this study, the FVI ranged from 0.95 to 1. Several questions might be challenging to comprehend, such as K1, K4, K26, K27, and K29. Some revisions were made by adding information and modifying sentences. The alpha coefficient of the nutritional factors was lower, whereas that of the health factors and the overall score were higher. The alpha coefficients of more than 0.6 shows an acceptable internal consistency.30 A low alpha coefficient could be attributed to a small number of questions, poor interrelatedness between items, or heterogeneous constructs. Herein, the low alpha coefficient could be related to the small number of questions; hence, some items needed to be either revised or deleted.33

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### Conclusion

DDR-GizKes is a valid and acceptable tool for the
early detection of the nutritional and health risk factors of urban workers’ productivity. The items developed are acceptable, but revisions are still needed. Future studies must optimize the predictive accuracy of DDR-GizKes by involving more experts and participants.

Abbreviations
NCD: Noncommunicable Disease; COVID-19: coronavirus disease 2019; DDR-GizKes: Deteksi Dini Faktor Risiko Gizi dan Kesehatan; CVI: Content Validity Index; FVI: Face Validity Index; I-CVI: Item-level Content Validity Index; S-CVI: Scale-level Content Validity Index; UA: Universal Agreement; Ave: Average; S-CVI/Ave: Scale-level Content Validity Index based on the Average Method; S-CVI/UA: scale-level Content Validity Index based on the Universal Agreement Method; I-FVI: Item-level Face Validity Index; S-FVI: Scale-level Face Validity Index.

Ethics Approval and Consent to Participate
This study obtained protocol and procedure approval from the Research and Community Engagement Ethical Committee of Health Science of Respati University of Yogyakarta (No. 120.3/FIKES/PL/VIII/2022). Permission to collect data in the ten offices was obtained from official authorities. Respondents who agreed to participate in this study were asked to sign an informed consent form.

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
The data presented in this study are available in this article.

Authors’ Contribution
Conceptualization: HMEN, AKE, and CRW; Data curation: HMEN, AKE, and CRW; Formal analysis: HMEN and AKE; Methodology: HMEN and AKE; Validation: HMEN, AKE, and CRW; Writing—original draft: HMEN; Writing—review and editing: HMEN, AKE, and CRW. All authors have read and agreed to the published version of the manuscript.

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References
19. World Health Organization. The WHO STEPSwise approach to non-communicable disease risk factor surveillance WHO STEPS surveillan-