FROM SCHOOLBOY INTO FULL-TIME ATHLETE: EXPLORING SLEEPING HABITS AND DIETARY INTAKE OF JUNIOR FOOTBALL PLAYERS IN EAST JAVA

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ABSTRACT

Junior football players often encounter difficulties in managing their sleep and dietary patterns. At the same time, they need to balance their time between scheduled school activities and training sessions. This dual responsibility can sometimes make junior athletes susceptible to sleep and dietary issues, potentially affecting their performance. This study aimed to examine the sleep patterns and dietary intake of football players across different age groups at a football club in East Java. We compared the sleep patterns and dietary intake of players in the U18 (n=18), U16 (n=13), and U14 (n=8) categories. Data were collected through interviews using validated questionnaires. Dietary intake was assessed with a semi-quantitative Food Frequency Questionnaire (SQ-FFQ). Sleeping quality and quantity were assessed using structured questionnaire adapted from Pittsburgh Sleeping Quality Index (PSQI). The results showed no statistically significant differences in the quality or quantity of sleep across all groups ($p > 0.05$). However, a trend suggested that U18 players had slightly better sleep quality and quantity compared to the other groups. In contrast, the U18 group demonstrated significantly lower energy intake than the other groups ($p = 0.000$). The U16 group exhibited the best energy and nutrient intake among all age categories. In conclusion, older and younger player groups tend to overlook dietary patterns, while their sleep patterns remain relatively consistent.

Keywords: *Dietary habits, Football, Junior Athletes, Nutrients intake , Sleeping habits*

INTRODUCTION

The developmental journey of junior football players is characterized by a delicate balance between athletic demands and personal growth. As these athletes transition from school to the world of competitive sports, they are required to navigate complex schedules that integrate academic commitments with intensive training sessions. This dual responsibility poses significant challenges to their sleep and dietary habits, both of which are critical for physical development, recovery, and performance optimization (Amawi et al., 2024; Penggalih et al., 2021).

Adequate sleep is a cornerstone of athletic performance. It facilitates recovery, enhances cognitive functioning, and reduces the risk of injuries and overtraining (Bonnar et al., 2018; Clemente et al., 2021). However, evidence suggests that many young athletes fail to achieve the recommended sleep duration and quality due to early morning training, late-night sessions, and academic obligations (Brown et al., 2020; Lolli et al., 2024). Studies have shown that inadequate sleep can lead to fatigue, decreased concentration, and impaired decision-making, all of which are detrimental to an athlete's performance on and

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off the field (Fox et al., 2020). Additionally, sleep difficulties, often exacerbated by stress or caffeine consumption from sports supplements, are increasingly reported among junior athletes (Barnard et al., 2022).

Equally important is the role of proper nutrition in supporting the high energy demands of training and competition. Football, as a high-intensity sport, requires substantial macronutrient and micronutrient intake to fuel prolonged physical activity, promote muscle repair, and maintain overall health (Mendes et al., 2017). Young athletes, however, often face challenges in meeting their nutritional needs due to factors such as limited dietary knowledge, dependence on parental food choices, and constrained financial resources (Jenner et al., 2021). The phenomenon of Relative Energy Deficiency in Sport (RED-S) has been highlighted as a pressing issue among adolescent athletes, with long-term consequences that include impaired growth, metabolic dysfunction, and reduced athletic capacity (Ackerman et al., 2019; Charlton et al., 2022).

Despite the critical role of sleep and nutrition in athletic development, there is limited research exploring how these factors vary across different age groups within junior football players. A recent study highlighted gaps in nutritional awareness among athletes, with younger groups exhibiting lower adherence to dietary recommendations compared to older peers (Charlton et al., 2022; Staśkiewicz et al., 2023). Similarly, differences in sleep quality and coping mechanisms across age groups remain underexplored, despite their significant implications for recovery and performance (Lolli et al., 2024).

Understanding these differences is essential for tailoring interventions that address the specific needs of athletes at various stages of their developmental and competitive journeys. This study aims to fill this gap by analyzing the sleep habits and dietary intake of junior football players in East Java, Indonesia, across three distinct age groups: U14, U16, and U18. Using validated tools, we assessed key indicators such as sleep duration, satisfaction, and difficulties, as well as dietary adequacy in relation to energy and nutrient requirements.

METHODS

Study Design and Participants

In total, 39 junior male football players on training session participated in this cross-sectional study. The collection of the data was done during a nutrition workshop for junior football players in Malang, East Java. All participants had been informed of the current study and signed the consent. For participants under 18 years old, the parents or the coaches gave consent on behalf of them. We provided presentations and information to the participants, their parents and coaches to invite them to participate in this study. Participants were categorized into three groups, including U18 (n=18), U16 (n=13), and U14 (n=8). The information collected in each group was analyzed by comparing the differences. Ethical permission was obtained from Universitas Airlangga, Faculty of Dental Medicine, Health Research Ethical Clearance Commission, under the certificate number of 1038/HRECC.FODM/X/2024.

Data Collection

Several information was collected using previously validated questionnaires, including the sleeping habits, dietary intake, and health problems and injury. All participants were asked to fill out the questionnaire while being led by several enumerators. To evaluate the sleeping habits, we assessed the sleeping duration, sleeping satisfaction and the presence of sleeping difficulties for the last two weeks. The dietary intake was assessed using semi quantitative food frequency questionnaire (SQ-FFQ). We evaluated food consumption for a month before data collection. The sleeping habits were evaluated by interviewing the participants using a questionnaire adapted from PSQI to assess the quantity and quality of the sleep.

Data Analysis

All statistical analyses were done in R Studio software version 4.4.0. The energy and nutrients intake were measured in NutriSurvey2007 program, employing Indonesian food database. We compared the energy intake of the participants with the previously measured energy expenditure for junior football players during training sessions

in English Primer League Academy (Hannon et al., 2021) to obtain the percent energy intake. The standard energy expenditure for each group was 2859 kcal for U14, 3029 kcal for U16, and 3585 kcal for U18 (Hannon et al., 2021). The energy from macronutrients, including protein, fat and carbohydrates as well as sugar were then compared to total energy to evaluate their contribution to daily energy intake. Meanwhile, the intake of dietary fiber and micronutrients, including calcium, iron, zinc, natrium and vitamin C, were evaluated according to Indonesian recommended dietary allowance (RDA).

The sleeping habits were categorized according to the sleeping duration, satisfaction and difficulties. Sleeping duration was scored from 1 to 5, which 1 indicated a severe sleep deprivation when sleeping duration was less than 6 hours a day, while 5 for severely excessive sleeping duration, which was more than 12 hours a day. Sleep satisfaction was analyzed after categorizing it into five indicators, from very unsatisfied into very satisfied. Meanwhile, sleeping difficulties were categorized as frequency level of never to always. The health problems and injury were presented as a severity score following the protocols of the previous study (Chikih et al., 2024).

The total energy and nutrients intake in each group were then tested for the differences using Kruskal-Wallis nonparametric test, followed by Dunn-Bonferroni post-hoc test. Meanwhile, the sleeping habits were tested for differences using Pearson's Chi-square test.

RESULTS AND DISCUSSIONS

Characteristic of The Participants

We assessed several characteristic of the football players, including the age, gender, family member, the income, food purchasing and expenses. All football players participated in this study were male, aged between 12 – 18 years old, and categorized in three different squad groups, which were U14, U16 and U18. Most of U14 players were lived with more than four family members, while for U16 and U18 players lived with 2 – 4 family members (Table 1). It was interesting that a qualitative study reported that food choices and preferences in football players could be influence by the member of the family (Jenner et al., 2021). It was also reported that the football players showed a greater nutritional adherence when supported and motivated by the family members (Carter et al., 2023). However, it was not clear whether the number of family members could influence the nutritional adherence or not. Our data could not provide the evidence on the association between number of the family members and diet among squads group.

We observed that online food purchasing among squads group was unique, with a tendency of less interest to utilize the existing online food application in the older squad group (U18), although, the trend was not statistically different among groups. Interestingly, the food expenses were greater in the older group, indicating that younger players purchased cheaper food or less food than the older group. It was reasonable since football players in U14 and U16 group were still dependent to their parents (Ziegler et al., 2021). The transition was clearly depicted from the monthly income and food expenses, which were statistically different among groups, showing that food dependency in U14 was no longer observed in U18 (Table 1). However, the proportion of food expenses to their income was comparable among groups, with the highest percentage was in U18 (Table 1). All of the groups spent more than 50% of their income for food, indicating that they were vulnerable to food insecurity according to Engel's Law (Valente et al., 2024).

Sleeping Habits

A good quality and quantity of sleep was associated with a greater performance in athletes, improved immune response, mood and decreased the risk of injury (Bonnar et al., 2018; Brown et al., 2020; Penggalih et al., 2021). For junior football players, whom training session usually restricted by school timetables, both quantity and quality of their sleep could be affected. Usually, training session took place early in the morning, before school, and late in the evening, after school. Study in adolescent football players reported that morning training session decreased the sleeping duration (Brown et al., 2020). Moreover, the caffeine intake from supplement or sport drink

exacerbated the sleeping difficulties in athletes (Barnard et al., 2022).

We observed that the sleeping duration, satisfaction and difficulties were not statistically different among groups. About 37.5% of players in U14 were reported to have inadequate sleep duration, which was the highest among groups. Meanwhile, in U18 the proportion of players with adequate sleep duration was the highest (Table 1). Our findings suggested that the risk of sleep deprivation could be experienced early in their athletic career. This finding was in line with the sleep satisfaction of the participants, that U14 had the most unsatisfied players (25%) and U18 had the least unsatisfied players (5.6%), indicating that the duration of sleep resulted in the satisfactory of sleep.

Interestingly, it was found that players with sleeping difficulties were more frequent in U18 (61.2%), but less frequent in U14. Sleeping difficulties might result to sleep deprivation and sleep dissatisfaction as well as health status (Burke et al., 2019; Clemente et al., 2021; Lolli et al., 2024). Yet, in this study the older athletes could tolerate the difficulties better than younger athletes. We assumed that the older athletes had been adapted with the training-school schedule and could manage their stress better.

It has been frequently reported that most football players, from junior to senior as well as from amateur to professional, did not meet age-specific sleep recommendation (Burke et al., 2019; Fältström et al., 2022; Lolli et al., 2021; Penggalih et al., 2021; Silva et al., 2022). Sleep deprivation, less than eight hours per day, could manifest into cognitive problem and increase the risk of overreaching as well as overtraining in football players (Fox et al., 2020). In other words, sleep quantity and quality can be an early indicator of fatigue accumulation. It is suggested to consider applied strategies to manage sleep in young football players, such as warm showering before bed, which has been observed to reduce sleep difficulties and improve the quality of sleep (Whitworth-Turner et al., 2017). Also, it was suggested for athletes to increase sleeping duration by taking a 1 to 2 hours daytime nap (Romyn et al., 2018). Other strategies including consistent bed and wake times, reducing caffeine intake from supplement or ergogenic aids, and managing screentime or gadgettime prior to bed, were recommended to improve the quality and quantity of sleep in young athletes (Fox et al., 2020).

Dietary Habits

The main factor that influences performance of an athlete is a good dietary habit. Both macronutrients and micronutrients intake are pivotal to support their performance (Macuh et al., 2023). We observed that there was a significant difference for energy adequacy between U18 players and U16 as well as U14 players (Figure 1.a), in which the players of U18 had the least percentage of energy intake compared to their needs. The U16 group demonstrated the highest level of energy adequacy, with a mean ± SD of 109.4 ± 44.37%, implying that only U16 met the energy requirements. Meanwhile the energy adequacy of U14 and U18 was 81.73 ± 25.83% and 69.05 ± 30.39%, respectively, demonstrating a relative energy deficit in sport (REDs). It was also observed that the energy intake of U18 was the lowest among groups, with U16 as the highest (Table 1). The low energy adequacy in U18 could be explained by their food choices that has low energy density. Also, according to previous study, there was a difference in dietary awareness among junior athletes (Staśkiewicz et al., 2023).

Although the energy intakes of all squad groups were higher than the requirement for non-athletes, REDs in young football players could increase the risk of malnutrition, resulting in a decline in performance (Barnard et al., 2022; Charlton et al., 2022; Logue et al., 2020). This finding supported former study that reported REDs in junior football players (Ackerman et al., 2019; Amawi et al., 2024), resulting in metabolic and physiological disturbance such as impaired growth, gastrointestinal function, immunological health, and increased cardiovascular risk, (Ackerman et al., 2019). Also, REDs would decline the endurance performance, training response, coordination and concentration, as well as increase the risk of injury (Ackerman et al., 2019; Charlton et al., 2022; Gould et al., 2021; Stenqvist et al., 2023)

Table 1. Characteristic, sleeping habits and dietary intake of football players in each squad groups (N=39)

	U14 (n = 8)	U16 (n=13)	U18 (n=18)	Total (n = 39)	*p*-value*
			n (%)		
Family Member					
<2	0 (0)	0 (0)	0 (0)	0 (0)	0.290
2-4	3 (37.5)	9 (69.2)	12 (66.7)	24 (61.5)	
>4	5 (62.5)	4 (30.8)	6 (33.3)	15 (38.5)	
Online Food Purchasing					
Never	2 (15)	7 (53.8)	10 (55.6)	19 (48.7)	0.500
Rarely	5 (62.5)	6 (46.2)	7 (38.9)	18 (46.2)	
Occasionally	1 (12.5)	0 (0)	1 (5.6)	2 (5.1)	
Often	0 (0)	0 (0)	0 (0)	0 (0)	
Always	0 (0)	0 (0)	0 (0)	0 (0)	
Supplementation					
Yes	5 (62.5)	4 (30.8)	10 (55.6)	19 (48.7)	0.270
No	3 (37.5)	9 (69.2)	8 (44.4)	20 (51.3)	
Sleeping Duration					
Severely Inadequate	0 (0)	1 (7.7)	0 (0)	1 (2.6)	0.597
Inadequate	3 (37.5)	4 (30.8)	2 (11.1)	9 (23.1)	
Adequate	4 (50)	6 (46.2)	13 (72.2)	23 (59)	
Excessive	1 (12.5)	2 (15.4)	2 (11.1)	5 (12.8)	
Severely Excessive	0 (0)	0 (0)	1 (5.6)	1 (2.6)	
Sleeping Satisfaction					
Very unsatisfied	0 (0)	0 (0)	0 (0)	0 (0)	0.372
Unsatisfied	2 (25)	3 (23.1)	1 (5.6)	6 (15.4)	
Neutral	2 (25)	7 (53.8)	8 (44.4)	17 (43.6)	
Satisfied	4 (50)	3 (23.1)	7 (38.9)	14 (35.9)	
Very Satisfied	0 (0)	0 (0)	2 (11.1)	2 (5.1)	
Sleeping Difficulties					
Never	4 (50)	7 (53.8)	7 (38.9)	18 (46.2)	0.890
Rarely	4 (50)	4 (30.8)	9 (50)	17 (43.6)	
Occasionally	0 (0)	1 (7.7)	1 (5.6)	2 (5.1)	
Often	0 (0)	1 (7.7)	1 (5.6)	2 (5.1)	
Always	0 (0)	0 (0)	0 (0)	0 (0)	
			Mean ± SD		***p*-value****
Income (Rp/month)	450,000 ± 244,948[a]	738,333.33 ± 871,360.83[b]	1,477,777.78 ± 683,034.37[a,b]	1,027,894 ± 805,790	**0.000**
Food expenses (Rp/month)	256,250 ± 142,521[a]	409,166.66 ± 607,490.49[b]	869,444.44 ± 527,797.56[a,b]	595,000 ± 560,539	**0.000**
Food expenses (%/month)	58.8 ± 24.2	53.02 ± 27.78	60.56 ± 24.91	57.82 ± 25.24	0.590
Energy (Kcal)	2658.65 ± 994.2	3452.05 ± 1145.07[b]	2256.53 ± 997.96[b]	2737.53 ± 1152.06	**0.010**
Protein (g)	119.76 ± 63.97	143.55 ± 49.32[b]	85.18 ± 45.26[b]	111.74 ± 55.97	**0.007**
Fat (g)	83.75 ± 47.30	113.17 ± 44.12[b]	62.69 ± 37.41[b]	83.84 ± 46.47	**0.011**
Carbohydrate (g)	361.35 ± 119.06	482.7 ± 191.22[b]	344.29 ± 174.91[b]	393.9 ± 178.69	**0.035**
Free Sugar (g)	33.425 ± 50.71	22.91 ± 22.13	27.88 ± 35.08	27.36 ± 34.55	0.952
Dietary Fiber (g)	11.24 ± 4.16	18.97 ± 9.27[b]	12.43 ± 35.08[b]	14.36 ± 9.77	0.010
Calcium (mg)	1248.5 ± 831.41	1585.45 ± 783.87[b]	865.8 ± 496.71[b]	1184.19 ± 731.92	**0.015**
Iron (mg)	30.92 ± 27.95	34.8 ± 14.23b	19.08 ± 10.42[b]	26.75 ± 17.61	**0.009**
Zinc (mg)	9.48 ± 4.25	12.19 ± 4.29b	8.32 ± 3.79[b]	9.85 ± 4.31	**0.044**
Sodium (mg)	1511.01 ± 1274.29	2142.59 ± 1016.83[b]	1178.87 ± 811.18[b]	1568.25 ± 1051.36	**0.020**
Vitamin C (mcg)	95.25 ± 88.67	204.02 ± 177.97	102.09 ± 81.71	134.66 ± 130.05	0.146

notes: * *p*-value was generated from Chi-square test, ** *p*-value was generated from Kruskal-Wallis nonparametric test. Bold *p*-value indicated significance difference among group U14, U16, and U18. [a] and [b] denotes groups in which the mean differences were statistically significant.

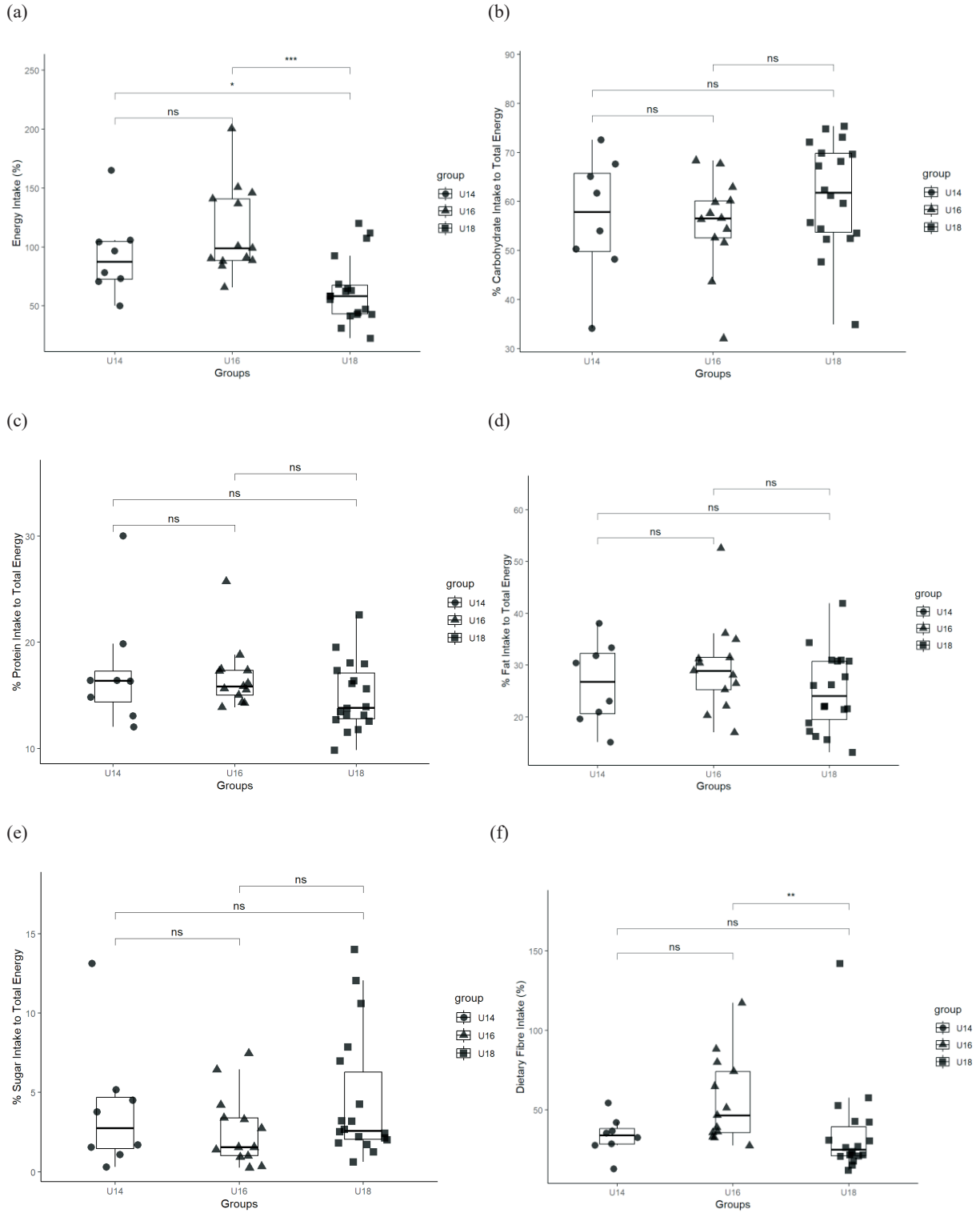

Figure 1. Energy and macronutrients intake of junior football players from each squad group (a) percent energy intake of participants compared to previously measured energy expenditure of junior football players (b) percent carbohydrate intake from total energy (c) percent protein intake from total energy (d) percent fat intake to total energy (e) percent sugar intake compared to recommended dietary allowance for each age-group (f) percent fiber intake compared to recommended dietary allowance for each age group. The differences among groups were tested using Kruskall-Wallis nonparametric test, followed by Dunn's-Bonferroni post hoc test. Statistical tests were conducted in Rstudio ver. 4.4.0. ns denotes not significant, asterix denotes a significant *p*-value. * indicates *p*-value <0.05, ** indicates *p*-value < 0.001, *** indicates *p*-value < 0.000. The bullets, triangle, and square represent the individual datum, horizontal line inside the bars and vertical line indicate median and interquartile range, respectively.

Conversely, the macronutrients intake of the participants, including carbohydrates, protein and fat, met the daily recommendation. The percentage of macronutrient intake to total energy was also not significantly different among groups (Figure 1.b-d). The daily recommendation of macronutrient for young athletes is higher than non-athletes, carbohydrate is 55 – 65%, protein is 15 – 20%, and fat is 25 – 35% of total energy (Mendes et al., 2017). The mean percentage of carbohydrate to total energy in U14, U16, and U18 was 56.72 ± 12.5%, 55.66 ± 9.7%, and 61.34 ± 10.97%, protein was 17.37 ± 5.6%, 16.7 ± 3.07%, and 14.96 ± 3.23%, fat was 26.57 ± 7.96%, 29.59 ± 8.85%, and 24.86 ± 7.55%, respectively.

Although the difference of the macronutrient intake was not statistically significant, the trend was consistent with the percent energy adequacy for protein and fat, but not carbohydrate, showing that U18 had the lowest protein and fat intake. In contrast, the carbohydrate intake of U18 was the highest. It is well-known that football players have higher carbohydrate requirements than non-players, and some studies suggest providing up to 600 gram/day or approximately 60-65% of total energy, and a minimum of 130gram/day (Amawi et al., 2024). It depends on several factors, including the athletes' training status, pre-exercise carbohydrate storage, exercise frequency, intensity and duration (Mendes et al., 2017).

We observed that total free sugar intake was not aligned with the carbohydrate intake. In U18 it was observed that the carbohydrate intake was the highest, but for free-sugar intake it was the lowest (Figure 1.e). yet our findings suggested differently. Usually, the higher intake of carbohydrate resulted in higher intake of free-sugar (Naughton et al., 2017). However, the participants' free-sugar intakes were not exceeding the daily recommendation cut-off of 10% from total energy intake, with mean ± SD for U14, U16, and U18 were 4.00 ± 4.07%, 2.53 ± 2.14%, and 4.55 ± 4.04%, respectively (Figure 1.e). Statistical tests showed that there was no significant difference among groups, indicating that all participants had sugar-less food choices, which contradicts the findings of Naughton et al. (2017) that reported sugar intake more than 10% in U14 and U16, but not in U18. Athletes have a higher risk to consume free-sugar especially from sport-drinks or snack bars (Naughton et al., 2017). Usually, the high sugar intake was followed by lower intake of dietary fiber (Bonsembiante et al., 2021). In this study, the average intake of dietary fiber for all participants was still lower than daily recommendation for adolescents (Table 1). The mean percent of fiber intake to daily recommendation for U14, U16 and U18 was 33.87 ± 11.81%, 55.69 ± 27.21%, and 34.88 ± 29.57%, respectively. We observed a significant difference between U16 and U18 (Figure 1.f), demonstrating a consistent trend with the micronutrients intake of both squad groups. The percent of micronutrients intake to daily recommendation was statistically significant between U16 and U18 (Figure 2.a-e), indicating that U16 had higher intake of fruit and vegetables as the sources of fiber and micronutrients. Micronutrients intake, especially calcium, iron, zinc, and vitamin C, was pivotal to enhance the performance of football players (Macuh et al., 2023; Mendes et al., 2017). Especially, for adolescent athletes who are in their growth period. Fortunately, the intake of the micronutrients in all squad groups met the daily recommendation. It is also important to monitor the intake of sodium in athletes, since the lack of natrium will also affect the muscle contraction and cardiac activity (Mendes et al., 2017). We also observed a good trend in the sodium intake of all squad groups.

The difference of dietary intake in the squad groups confirmed the former study that reports a gap in nutritional awareness in athletes from different age groups (Staśkiewicz et al., 2023). The younger the athlete the less their awareness of diet and nutritional needs, both for macronutrients and micronutrients. They also reported that nutritional knowledge was lacking in the younger athletes (Staśkiewicz et al., 2023). Unfortunately, the current study did not evaluate the awareness and knowledge of the participants, which needs further exploration in future research. It is also important to explore the impact of nutritional education on changing athletes' dietary habits and improving their performances.

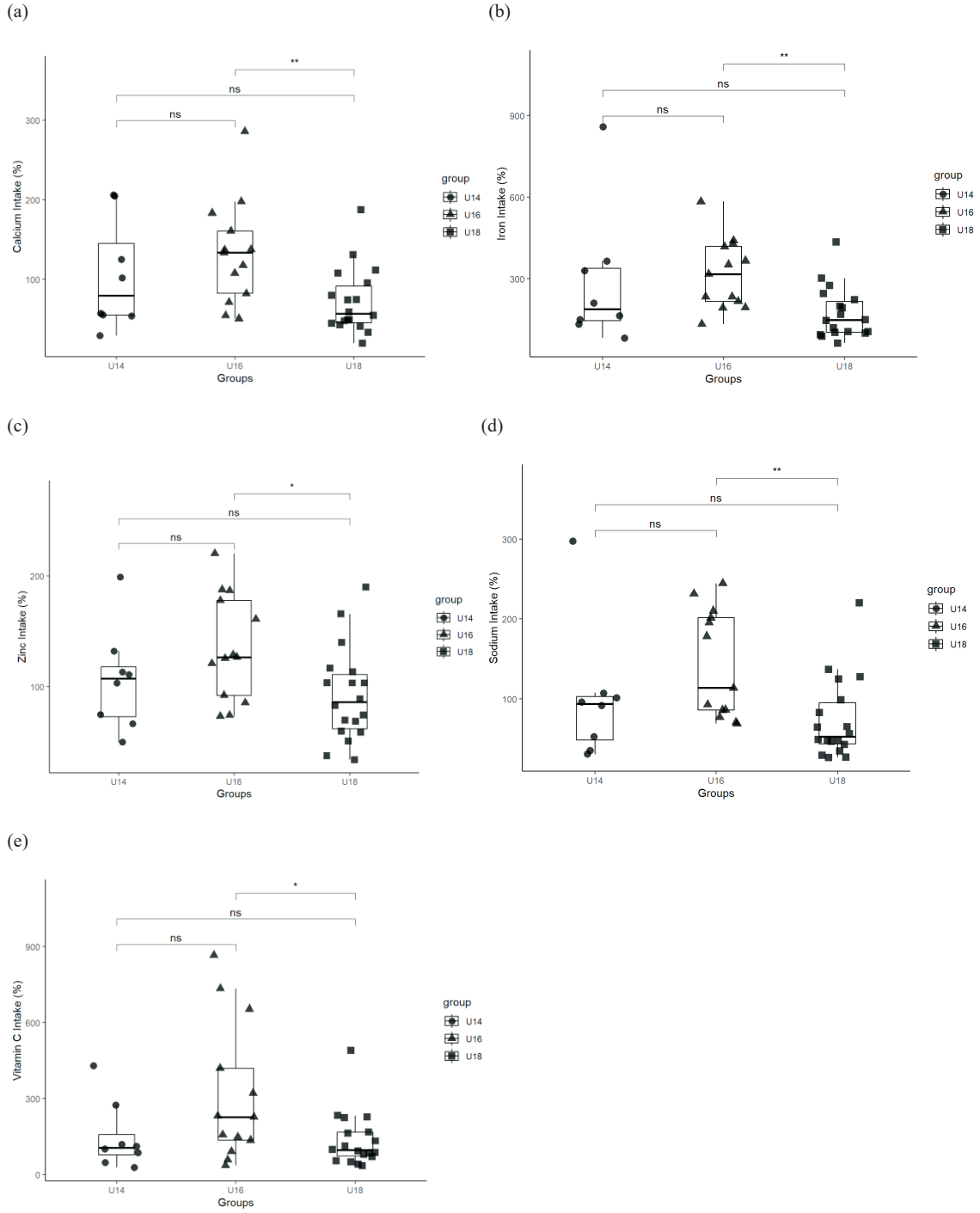

Figure 2. Percent micronutrients intake of junior football players compared to Indonesian recommended dietary allowance. (a) percent calcium intake (b) percent iron intake (c) percent zinc intake (d) percent sodium intake (e) percent vitamin c intake. The difference among groups were tested using Kruskall-Wallis nonparametric test, followed by Dunn's-Bonferroni post hoc test. Statistical tests were conducted in Rstudio ver. 4.4.0. ns denotes not significance, asterix indicate significant *p*-value. * indicates *p*-value <0.05, ** indicates *p*-value < 0.001, *** indicates *p*-value < 0.000he bullets, triangle, and square represent the individual datum, horizontal line inside the bars and vertical line indicate median and interquartile range, respectively.

CONCLUSION AND SUGGESTION

In summary, we found a transition in junior football players habits, although not all of them were statistically significant. Regarding sleeping habits, we found that older football players have more control over their sleep duration and feel satisfied with their sleep quality, unlike younger players. Conversely, the dietary habits of the younger football players was more satisfying than the older, in terms of energy and micronutrients intake. Yet, we found no difference in their macronutrient intake. It is necessary to provide nutritional education for junior football players before entering their full-time career.

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