Determining anemia & Iron status and their relation with the performance of professional Ethiopian Athletes.

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Presentation outline

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2. Statement of the problem
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1. Introduction

- The most common MN deficiencies include vitamin A, iron, iodine, vitamin B_{12}, zinc & folic acid.
- Almost 1/3 of world populations suffer from the MN deficiencies.
  - The cause of these MN deficiencies is primarily due to
  - prolonged inadequate dietary intake of foods rich in these nutrients. (Uchendu, 2011).
- Anemia is the decrease in number and size of RBCs or
- Decreased the amount of Hb in RBCs.
- Functional ID occur when ferritin level below the normal range (<12µg/L), WHO, 2011).
- Anemia and ID affects O_2 and CO_2 exchange b/n blood and tissue cells,
  - And iron is an important nutrient in sports that require endurance for success.
  - Thus, deficiency of this nutrient limits athlete's endurance and performance (Driskell & Wolinsky, 2006).

2. Statement of the problem

- There are researches done in different countries, such as
  - a study in Korea by kim *et al*., (2007), in Israel by Dubnov & Constantini, (2004) and in Sweden by Sandström in 2014,
  - They reported high prevalence of ID and IDA in professional athletes.
- There are few researches done with elite endurance Ethiopian runners:-
  - Demographic characteristics, Food & Ma.N intake,
  - Y-chromosome haplogroups, & Mitochondrial DNA lineages.
- unfortunately there is no any research has been done related to:-
- Hematological variables, Anemia & Some important MN status.

3. Objectives of the study

3.1 General Objectives

- To assess hematological variables, anemia & iron status then to find if there is any relation with performance of professional Ethiopian athletes.

3.2 Specific objectives

- To assesses FF & 24 Hr DD of the athletes.
- To Determine hematological variables by CBC analysis & compare with NRR.
- Determine infection/inflammation level by (α_1-AGP) indicator.
- To measure serum Ferritin, Transferin level and then compare with their NRR.
- Looking for the relation of performance with hematological variables & body iron status.

4. Materials and methods

4.1. The study site and study subjects.

- The field work was carried out in A.A national stadium in the period of February to April 2014.
- The study subjects were male and female athletes of (short, middle, long & marathon runners),
- Who registered and doing continuous training under EAF with their respective coaches.

Figure.1 study site and study subjects

4.2 Ethical clearance

- The research proposal was submitted and presented at *EPHI*
- Ethical clearance was obtained from the institute *SERO*.
- Before starting the field work & data collection, the EAF & the athletes were informed about
- the study objectives, importance & benefits of participation.
- Finally consent was obtained from each research participant athletes.

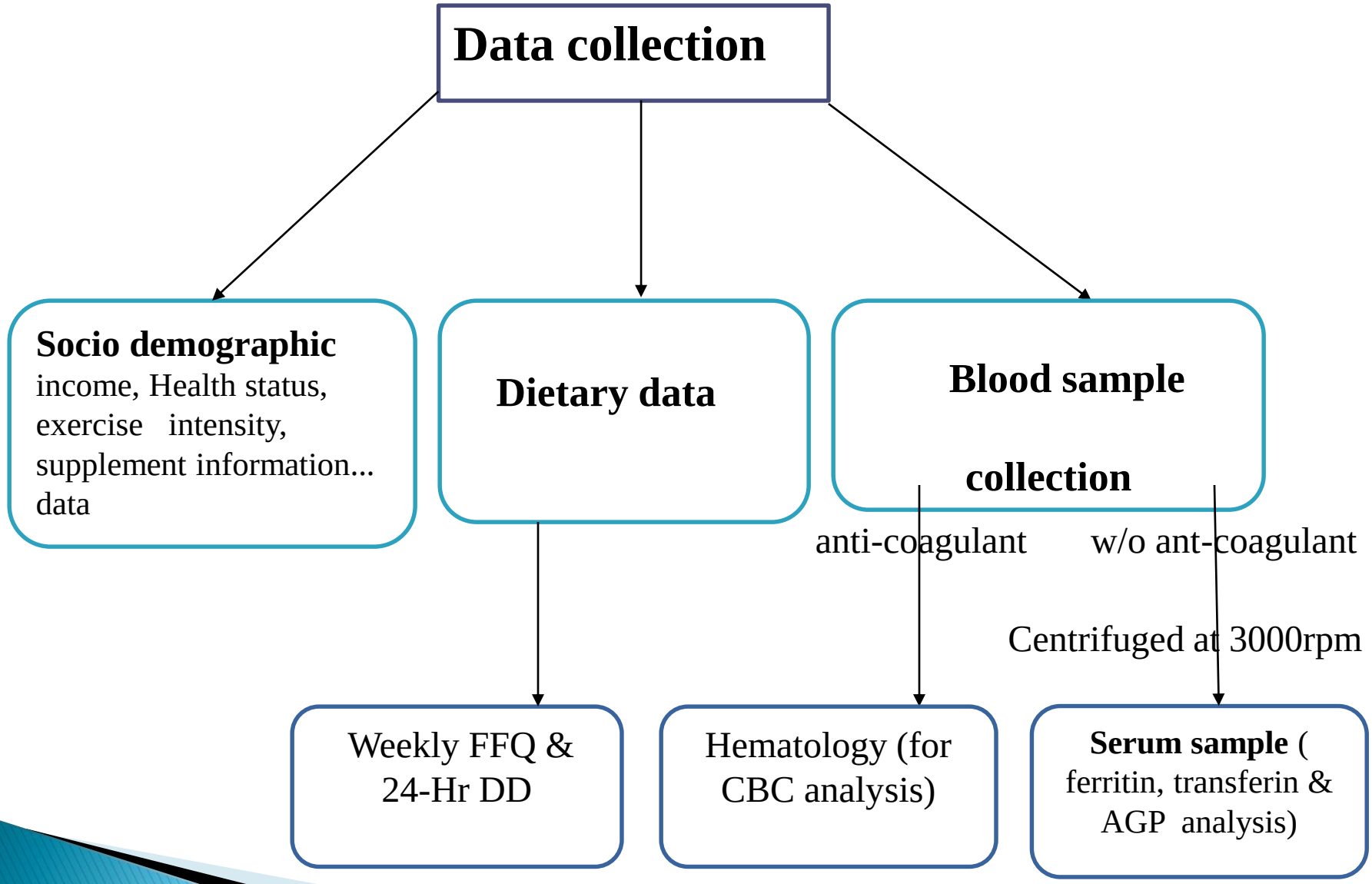
4.3 Sampling and Sample size

➢Using convenient sampling; a total of 101 national athletes were participated in the study.

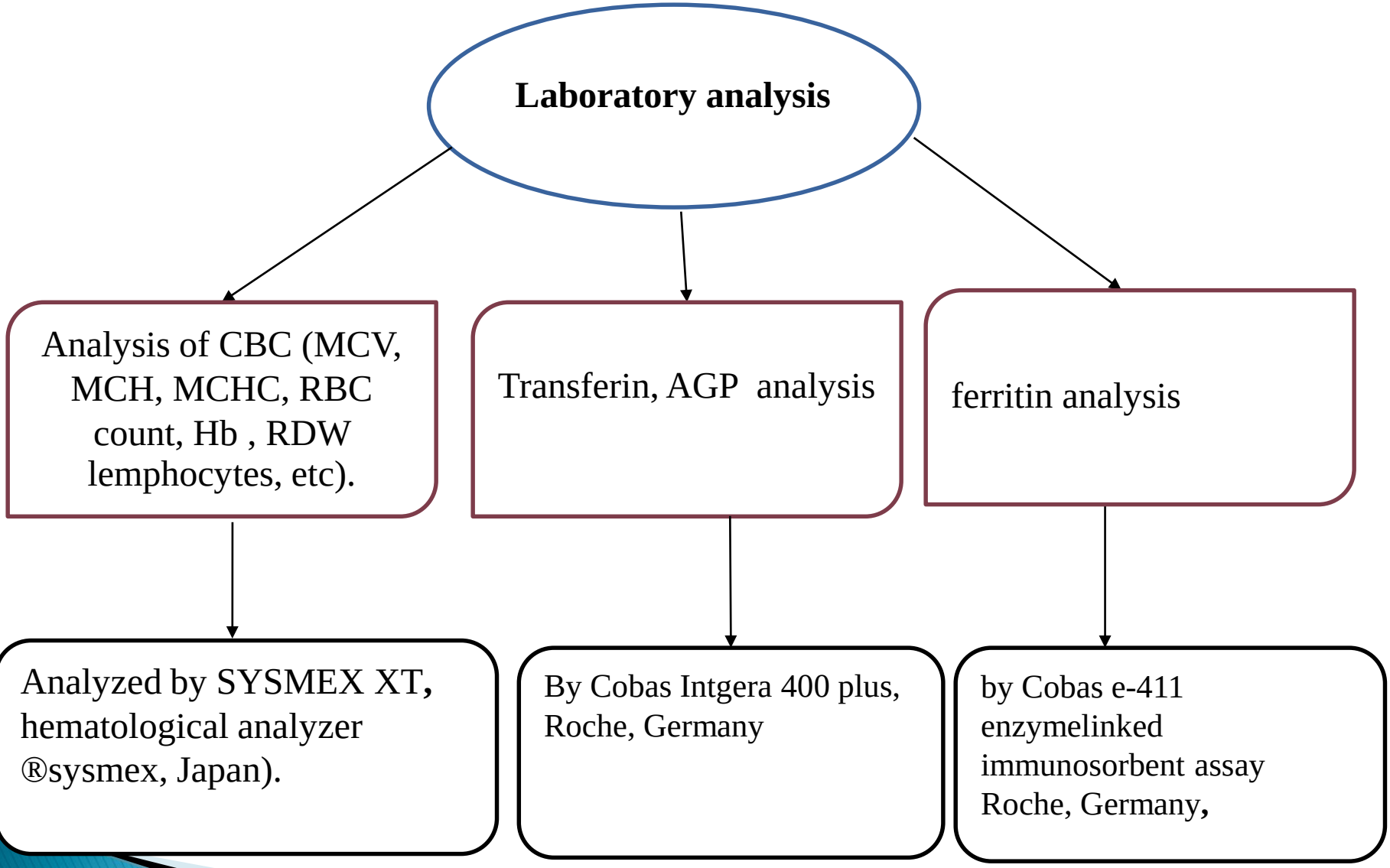
➢The study participants were stratified based on their running dis. & the research participant athletes were from:-

➢Marathon running (16), long distance (18), 3000m steeple chase (14), middle distance (22) & short distance (31).

4.4 Data collection frame work



4.5 laboratory analysis



4.7 statistical analyses

- All results from biochemical analysis & dietary assesment were analysed using SPSS version 20.
- The results of analyzed biomarkers & dietary data were summarized in terms of mean (x^-), median ($x^\sim$), (Sd), variance(V), quartile range (Q1, Q3) & correlation (r).
- And also to find sig. dif. at 95% CI ($p<0.05$).
- Given that the serum-ferritin data was skewed & did not meet the assumptions of normality ($p< 0.05$) for Shapiro-wilk test,
- so the log-transformed data was used for stat. analysis &
- the back transformed mean was used for inferential statistics.
- However, the AGP, RBC, Hb, & transferin data were fit for normality assumption, so, non-transformed data were used for inferential statistics.

Results & discussion

5.1 weekly diversity of food

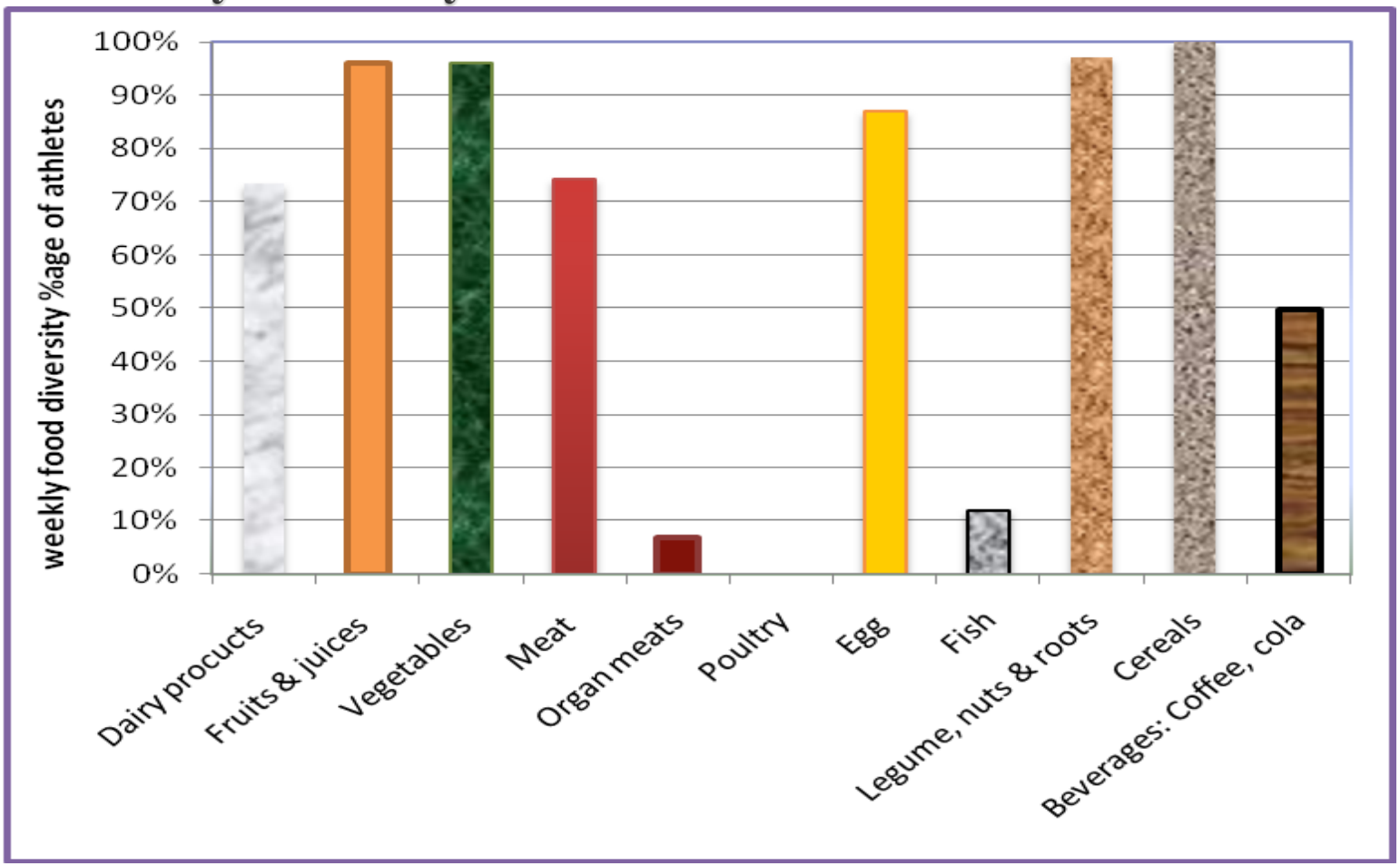
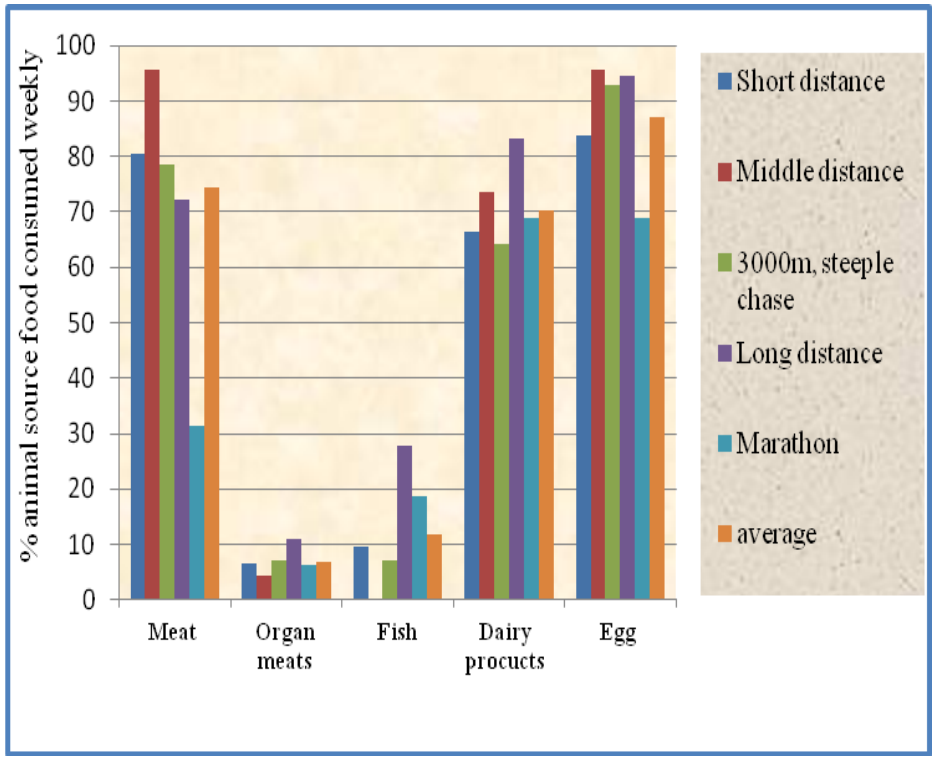


Figure:2 Weekly diversity of food consumption %age, by athletic popln

5.2 weekly diversity of food by dis. category



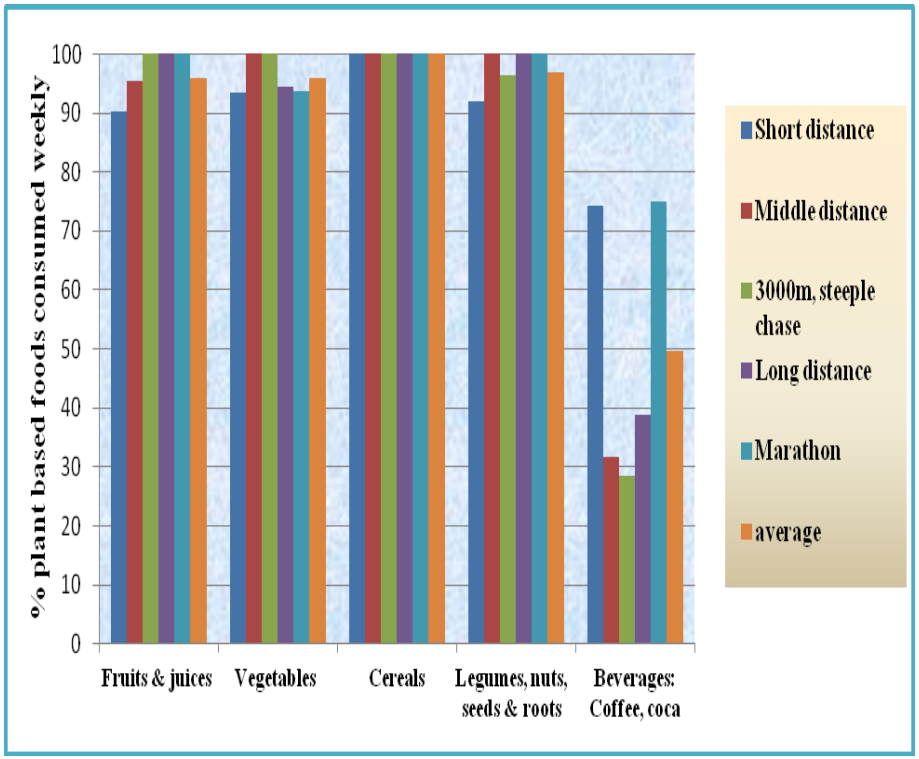


Figure:3 Animal & plant source food consumption %age by dis. category

5.2 Dietary diversity scores

Table 1: 24 Hr Dietary diversity scores

Dietary Diversity Terciles	**Short** (% div.)	**Middle** (% div.)	**3km steeples chase** (% div.)	**Long** (% div.)	**Marathon** (% div.)	**total**
Low (1 to 4)	38.71	40.92	14.3	**55.55**	31.25	36.1
Medium (5 to 9)	**58.1**	**54.6**	**78.6**	44.45	**68.75**	**60.9**
High (10 to 14)	3.23	0	7.14	0	6.25	3.3

The Dietary Diversity Scores (DDS) of individual subjects was ranged from 2 to 10. The overall mean DDS among subjects was 5.44 with a SD of 1.8

5.3 Health and inflammation status of the athletes

- Based on the interview of the athletes & AGP figures show that, most, if not all, had no medical conditions & thus were healthy.
- The normal reference range of α1-AGP biomarker is 0.5-1.2g/L (Roche diagnostic, 2010).
- only 2% athletes had >the UNV & 11% had an α1-AGP < the LNV.
- Among the 11% with lower AGP, the 9% had an α1-AGP of ≥0.31g/L, but the rest 2% had α1-AGP of ≤ 0.02g/L.
- Higher level of α1-AGP is an indication of presence of infection/inflamn.
- very low level of α1-AGP associated with in hospital mortality in a population of hospitalized elderly patients (Henry *et al*., 2003).

5.4 RBC & Hb level of athletes

- The mean ± SD of crude and alt. adj. Hb for male was 16.7 ± 0.82 Vs 15.4 ± 0.82 g/dL
- but for female athletes it was 15 ± 0.88 Vs 13.7 ± 0.88 g/dL.
- There was a sig. dif. b/n male and female Hb level at 99% CI.
- While the Hb dif. in running-dis. category was not stat. sig.
- The mean ± Sd of RBC count x (10^12/ L), for male and female athletes were (5.45 ± 0.34 & 4.85 ± 0.35 respectively.
- As in the case of Hb, there was sig. dif. b/n male and female RBC count at 99% CI.
- And the variation of RBC by running-dis. category was not stat. sig.
- The correlation b/n Hb & RBC count was sig. at 99% CI, ($p<0.001$).

5.5 Anemia status based on WHO Hb cut off

- According to the WHO Hb cut off points, for alt. adjusted;
- athletes w/c were anemic (Hb<12g/dL) was 3% (3 athletes).
- among them, 2 runner (1male & female) were from long dis.
- but the rest 1 male was from marathon running.
- Despite of relatively few runners participated, the presence of anemia in
- marathon & long dis. runners in contrast to short and middle,
- indicate that very long distance running affect Hb level negatively.

5.6 Iron status

- The non-log-transformed mean and Sd of ferritin for male & female athletes were, 134.1 ± 86.8 and 63.9 ± 40.4 µg/L respectively.
- Based on the cut off p.ts (ferritin<12 µg/L) the ID athletes were 2% (1male & 1female athlete).
- 1st stage iron dep. (ferritin <50µg/L, but>30µg/L) was 22% &
- 2nd stage iron dep. (ferritin<30 µg/L, but >12 µg/L) was 13% .
- among the 13% 2nd stage iron dep. 11% were females athletes.
- The mean ferritin & % of 2nd stage iron dep. showed that,
- the female athletes showed low iron store than male w/c is
- an indication of more vulnerability to ID.
- Iron overload for male, (ferritin>200 µg/L) in the absence of inflammation WHO, (2011); was 11%.
- Among all iron overload athletes 8% were from short dis. runners.

Iron cont…

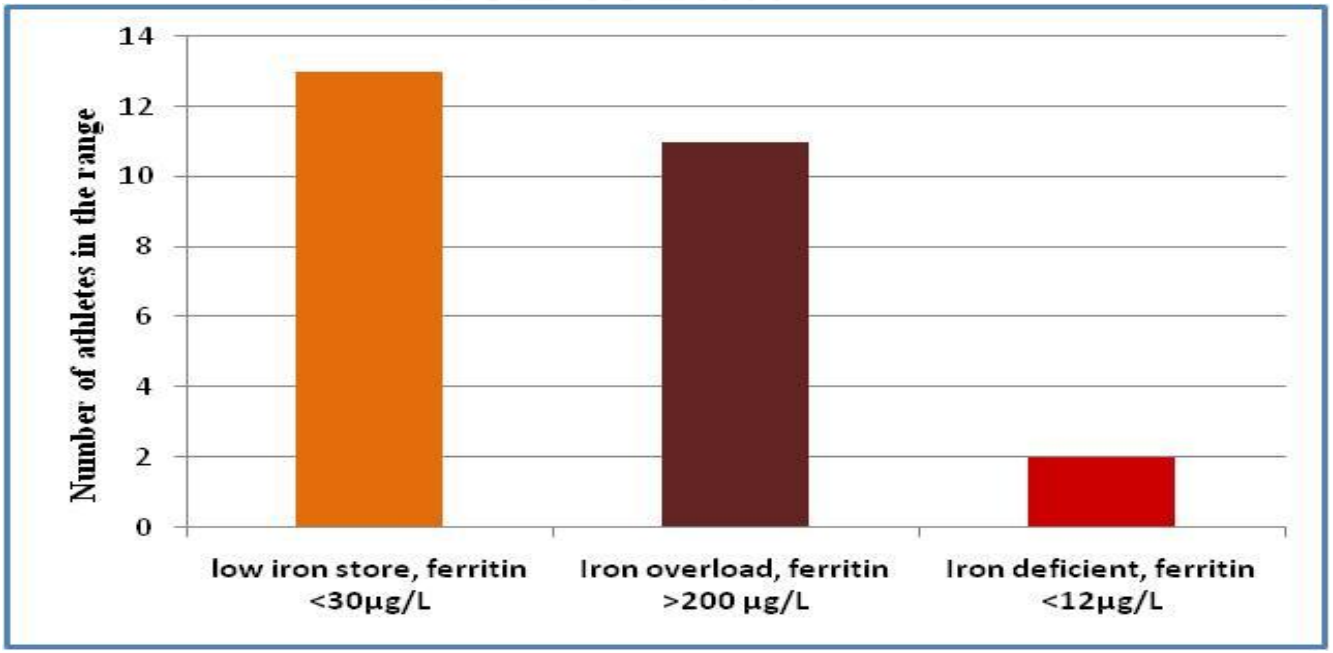


Figure 3: Iron status of overall athletes

- Among 44 female athletes 27.3% had low iron store (<30µg/L) but only 3.5% for male.
- This finding is fairly consistent with a study done in 42 Iranian female athletes participating in team ball sport in 2010, w/c a report of,
- low iron store in 33.3% & iron overload in 12.5% of the study participants (Ahmedi *et al*., 2010).
- But in this study no iron overload in female athletes.

Iron cont…

- Running distance category has brought sig. dif. in male atletes' ferritin level but not in female athletes at 95% CI.
- However transferin was not sig. in both male & female across running dis.

Table 2: statistically analyzed Gender partitioned ferritin by running distance

Distance category	Ferritin (male)	Ferritin (female)
Short distance (100-400m)	171 ± 1.5^{a}	52.0 ± 2.1^{a}
Middle distance (800-1500m)	72 ± 2.2^{b}	39.0 ± 2.2^{a}
Steeple chase (3km)	111 ± 1.8^{ab}	64.0 ± 1.6^{a}
Long distance (5 & 10km)	124 ± 1.8^{ab}	67.6 ± 2.3^{a}
Marathon (42.2km)	65 ± 2.2^{b}	41.4 ± 1.1^{a}

Supper script words of d/t letters in one column are statistically significant ($p < 0.05$)

- Despite of their food and MN intake, (EV) could affect iron status.
- mean ferritin of female same as male across running dis., but none of them were statistically sig.

Iron cont…

- A study done in Korea by kim *et al*., (2007), of runners (n=30), badminton players (n=8) &
- shooting athletes (n=26) the prevalence of anemia, ID & IDA were 23.4%, 23.4% & 14.0% respectively.
- There was a sig. dif. in the prevalence of ID among the 3 types of athletes;
- Runners & badminton players tend to affect more with ID than static athletes such as shooters.
- And the ID were 33.3%, 25.0% &19.2% respectively.
- But in the current study there was no anemia & ID together.

5.8 Variation of MN & hematological variables by gender

Table 3: Analysis of MN & hematological variables by sex

Variation of Micro nutrient and Hematological variables by sex (Mean ± Sd)			
Sex	**RBC**	**Hb**	**Ferritin**
Male	5.45 ± 0.34^{a}	16.7 ± 0.82^{a}	107 ± 2.1^{a}
Female	4.9 ± 0.35^{b}	15 ± 0.9^{b}	51 ± 2.0^{b}

Supper script words of d/t letters in one column are statistically significant ($p < 0.05$)

5.9 R/n of MNs & hematological variables with performance of the athletes'

- To investigate these association, data on performance for 2013 & 2014 archived best time (athletes' speed) were obtained from the EAF.
- And the data was categorized into high and low performers according to their fast & slow speed registered.
- The mean ± Sd of their hematological variables was calculated &
- For each of hematological variables & MN, the stat. analysis was done.
- to find sig. association ($p<0.05$) with performance of the athletes.

R/n cont…

Table 6: Hematological & MN values of high and low performer athletes

Hematological Variables (Mean ± Sd) of high performer Vs low performer athletes			
Male & female	Hb (g/dL)	RBC count x (10^{12})	Ferritin (µg/L)
High performer	16.2 ± 1.2^{a}	5.3 ± 0.14^{a}	84.5 ± 63.3^{a}
Low performer	15.5 ± 1.0^{a}	5.0 ± 0.14^{b}	88.6 ± 60.8^{a}

- The table shows that a higher RBC & Hb level exhibited by high performer
- However only RBC level was stat. significant with performance.
- Irrespective of gender differences, higher performers athletes had higher RBC values than their low performing counterparts ($p<0.05$).

6. Conclusions and Recommendations

- Athletes need relatively high fluid, macro & MN intakes to balance losses associated with strenuous exercise &
- high alt. fatigue with traumatic movement of running w/c leads to
- losses of minerals & vitamins through sweating, urination & hemolysis.
- So nutritional counseling & monitoring is mandatory.
- Given the 11% of athletes has serum ferritin >200µg/L w/c indicates iron overload.
- Dietary supplements such as iron-folate, multivitamins & mineral prescription should be based on clinical laboratory testing,
- Rather of by broad spectrum of suspecting MN deficiencies.
- In general, it is recommended to conduct iron overload assessment in Ethiopia healthy populations.
- Future studies should investigate the reason behind the observed high RBC in high performing athletes.

Acknowledgments

To **FSNRD & Hiv/Tb RD**

EPHI **AAU** **EAF**

The athletes

THANK YOU FOR YOUR ATTENTION!!