



## OCCUPATIONAL AND DOMESTIC ACTIVITY PROFILES AS DETERMINANTS OF PHYSICAL ACTIVITY LEVEL IN GRAIN-FARM WORKERS OF KARAKALPAKSTAN

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**Abstract:** *Daily energy requirements in agricultural populations are shaped not only by total workload but also by the functional distribution of occupational, commuting, domestic and recovery activities. Objective: To analyze the structure of daily energy expenditure and the physical activity level (PAL; total energy expenditure/basal metabolic rate) among grain-farm workers in Karakalpakstan. Methods: A 24-hour time-motion approach was used for two seasonal periods. Basal metabolic rate was calculated from anthropometric data, and activity-specific energy costs were estimated using physical activity coefficients. Results: Men had a very high PAL in both seasons (2.62 in winter–spring and 2.68 in summer–autumn). Women had a lower but still elevated PAL (1.97 and 1.96). The male profile was dominated by field work and commuting, whereas women’s expenditure was distributed across domestic work, childcare, walking, self-care and recovery. Conclusion: PAL-based interpretation reveals that the same farming community contains two distinct energy-expenditure models: a male occupational-load model and a female distributed-load model. Nutrition planning should therefore combine total energy targets with activity-structure analysis.*

**Keywords:** *physical activity level; time-motion study; agricultural work; basal metabolic rate; total energy expenditure; occupational health; nutrition.*

### INTRODUCTION

Estimating energy requirements in agricultural workers requires a combined view of basal metabolism and activity-related expenditure. Predictive equations for basal metabolic rate have a long methodological history, beginning with the Harris-Benedict work and continuing through later reviews and standards [1–3]. These equations are particularly useful

when direct calorimetry is not feasible in field studies.

Activity classification systems such as the Compendium of Physical Activities provide standardized MET values for comparing the energy cost of human activities across studies [4,5]. Their relevance is high in occupational health, because work energy cost is linked to fatigue, heat production and nutritional needs. A systematic review of worker



energy cost reported agriculture as one of the most energy-demanding sectors and emphasized the need for sex- and task-specific assessment [6].

A second methodological issue is seasonality. Agricultural populations may experience substantial changes in total energy expenditure and PAL between peak and slack seasons [7,8]. In addition, women's workloads in rural settings often combine economic, domestic and caregiving responsibilities, making total daily activity more distributed and less visible than field work alone [9,10]. This article therefore focuses on activity structure rather than simply repeating total energy expenditure comparisons.

**The aim of this article** was to interpret the same time-motion dataset through the TEE/BMR ratio and functional activity blocks, thereby distinguishing occupational-load and

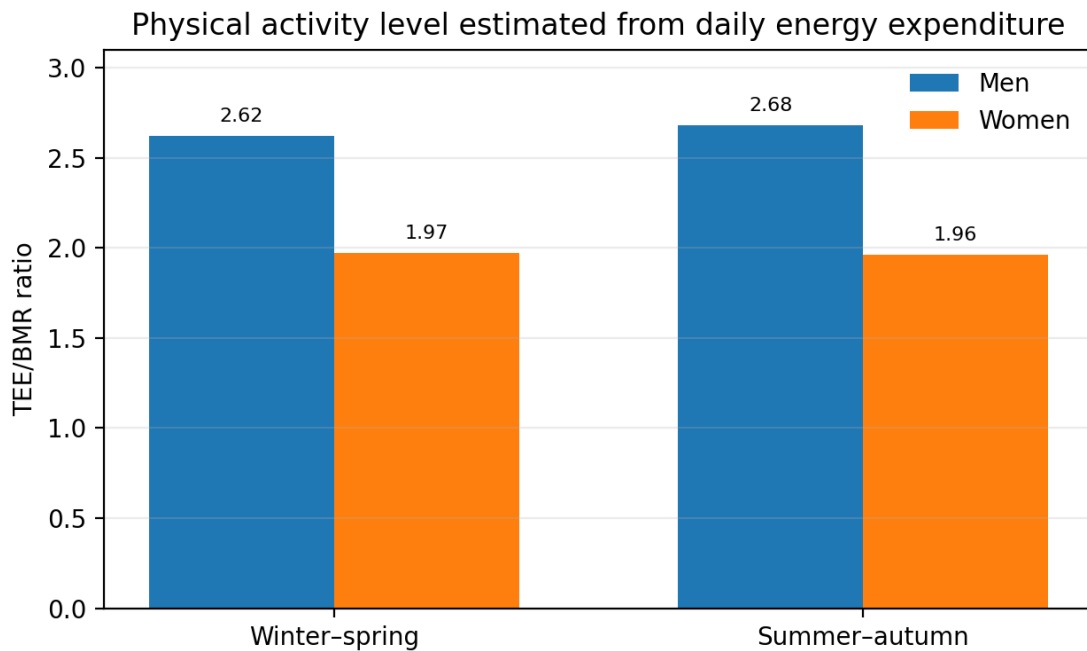
distributed-load profiles in grain-farm workers.

**Materials and Methods.** The analysis used the same 24-hour time-motion dataset for grain-farm workers in two seasonal periods: winter–spring and summer–autumn. Each activity was assigned a physical activity coefficient, and total daily energy expenditure (TEE) was obtained by summing activity-specific energy costs. Basal metabolic rate (BMR) was calculated from sex-specific anthropometric characteristics. PAL was calculated as TEE/BMR.

For structural interpretation, activities were grouped into four functional blocks: occupational and commuting load; domestic and childcare load; self-care and meals; and leisure, rest and sleep. This grouping was used to evaluate whether similar daily totals reflected similar or different workload models.

**Table 1. Basal metabolism, total energy expenditure and estimated physical activity level**

Group	BMR, kcal/day	Winter–spring TEE	Summer–autumn TEE	PAL winter–spring	PAL summer–autumn
Men	1590.625	4162.0±224.6	4267.8±224.6	2.62	2.68
Women	1237.5	2437.1±100.4	2426.2±100.4	1.97	1.96



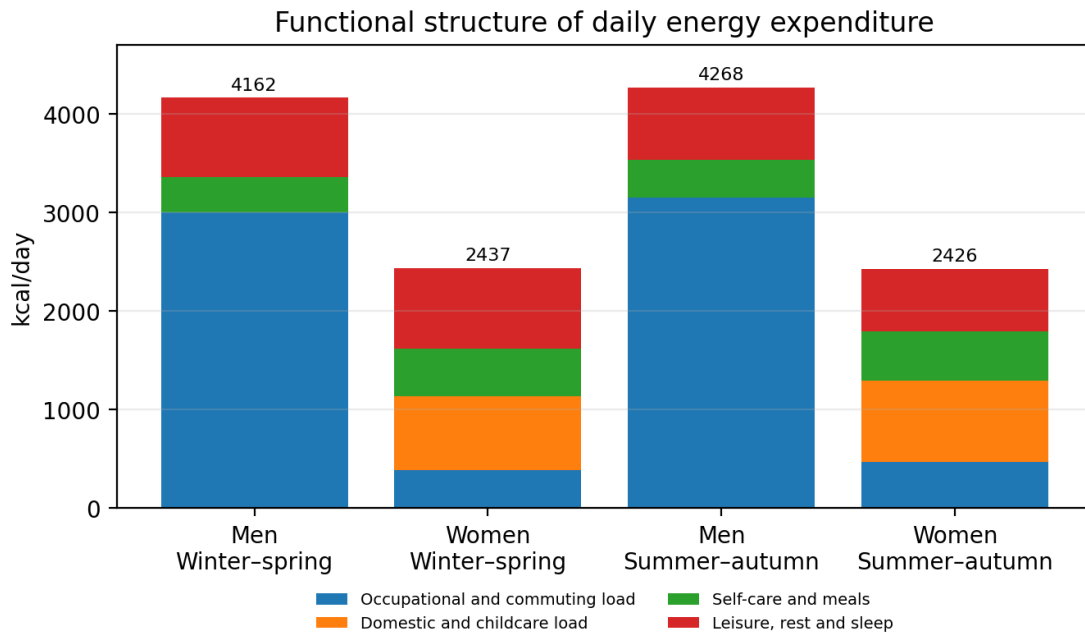
**Figure 1. Physical activity level estimated as the ratio of total energy expenditure to basal metabolic rate.**

**Results.** The TEE/BMR ratio indicated a very high activity level among men in both seasons: 2.62 in winter–spring and 2.68 in summer–autumn. Women had lower but still elevated ratios: 1.97 and 1.96, respectively. Therefore, the sex difference was not limited to total kcal/day; it also reflected different relationships between daily expenditure and basal metabolic needs.

Functional grouping showed that men’s daily energy expenditure was dominated by occupational and commuting load: approximately 3002.5 kcal/day in winter–spring and 3148.1 kcal/day in summer–autumn. Women’s expenditure was more distributed. Domestic and childcare activities accounted for 753.8 kcal/day in winter–spring and 825.1 kcal/day in summer–autumn, while occupational/commuting components accounted for 383.5 and 471.6 kcal/day.

**Table 2. Functional structure of daily energy expenditure, kcal/day**

Functional activity block	Men winter–spring	Women winter–spring	Men summer–autumn	Women summer–autumn
Occupational and commuting load	3002.5	383.5	3148.1	471.6
Domestic and childcare load	0.0	753.8	0.0	825.1
Self-care and meals	351.7	482.5	382.5	495.9
Leisure, rest and sleep	807.6	817.4	737.2	633.6



**Figure 2. Functional blocks of daily energy expenditure in men and women across seasons.**

**DISCUSSION**

The PAL-based approach changes the interpretation of the dataset. Men’s values above 2.6 point to a very high physical activity level and reflect the concentration of work energy cost in field operations, tractor driving and irrigation. This agrees with occupational energy-cost literature in which agriculture is consistently classified among the most demanding work sectors [6].

Women showed a different pattern: PAL was lower than in men, but the activity profile was distributed over domestic work, childcare, walking, self-care and recovery. This is important because distributed workload may be underestimated when only formal agricultural operations are considered. PubMed-indexed evidence on farm

women and women’s workload supports the need to account for domestic and reproductive roles when evaluating health and nutritional status [9,10].

From a practical standpoint, nutrition planning should not be based on a single average worker. Men in the dataset require energy coverage for highly concentrated occupational expenditure, whereas women require a dietary approach that recognizes long-duration domestic and movement-related activity. Seasonal adjustment appears more necessary for men, while sex-specific structure is critical for both groups.

**CONCLUSIONS:**

1. Men had a very high PAL in both seasons, rising from 2.62 to 2.68,



mainly because of seasonal intensification of field work and irrigation.

2. Women had a stable PAL close to 1.96–1.97, with energy expenditure distributed across domestic work, childcare, walking and self-care.

3. The grain-farm worker population should not be modeled as a

single homogeneous nutritional group; sex and activity structure must be considered simultaneously.

4. PAL and functional activity-block analysis are useful additions to total kcal/day estimates in field-based occupational nutrition studies.

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